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Canada Tomorrow Conference

November 6-9, 1983

PROCEEDINGS

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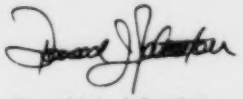
FOREWORD

The CANADA TOMORROW CONFERENCE, held from November 7 to 9, 1983, in Ottawa, was part of the federal government's efforts to place the issues related to the new technologies before the people of Canada. It allowed participants from business, labour, academia, government and various interest groups to exchange views about technological change, its impact and the actions needed to manage the change.

The CANADA TOMORROW CONFERENCE served as a starting point for the continuing consultation required to mobilize Canadians to maximize the benefits offered by the new technologies.

These Proceedings present a verbatim account, with translation, of the plenary sessions at the CANADA TOMORROW CONFERENCE.



Donald J. Johnston
Minister of State
Science and Technology
Economic and Regional
Development

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"CANADA TOMORROW" CONFERENCE

Ottawa November 7 - 9, 1983

AGENDA

Monday, November 7, 1983

9:00 am. **OPENING ADDRESS**
Rt. Hon. Pierre Elliott Trudeau
Prime Minister of Canada

9:30 am. **The World Context**
"The management of technological change in the world's leading industrialized nations."

Speakers:
Dr. George Keyworth (United States)
Science Advisor to the President and Director, Office of Science and Technology Policy

Mr. Masahiro Sakamoto (Japan)
Councillor to the Minister of the Economic Planning Agency

Mr. J.-J. Servan-Schreiber (France)
President of the World Centre for Information and Human Resources

2:00 pm. **Panel Discussions**

Panel Discussion No. 1:
"Technology in Canada's Future" and "Concerns About the Consequences of Change"

Leader: Dr. John Evans

Panelists:
Dr. J.C. Madden
Mr. Guy Saint-Pierre
Mr. James A. McCambly
Dr. Margaret Fulton

4:00 pm. **Panel Discussion No. 2:**
"Putting the Technology in Place" and "Adjusting to Change"

Leader: Ms. Lucie Pépin

Panelists:
Dr. Wendy Dobson
Mr. Larry Clarke
Mr. Marcel Pepin
Dr. Norman Wagner

5:30 pm. **Summary of Panel Discussions**
Dr. Louis Berlinguet, Secretary, Ministry of State for Science and Technology and Chief Science Advisor to the Government

Tuesday, November 8, 1983

9:00 am. **Workshop Sessions**

20 concurrent sessions covering the themes of:

- **Technology in Canada's Future**
  Dr. Stuart Smith/Coordinator
- **Concerns About the Consequences of Change**
  Ms. Heather Menzies/Coordinator

12:00 pm. **Luncheon**

Speaker:
Mr. Vern C. German, Chairman
Canadian Manufacturers Association

2:00 pm. **Workshop Sessions**

20 concurrent sessions
covering the themes of:

- **Putting the Technology in Place**
  Roger Blais/Coordinator
- **Adjusting to Change**
  Ms. Jennifer McQueen/
  Coordinator

7:30 pm. **Banquet**

Speaker:
Mr. David A. Golden
Chairman
Telesat Canada

Wednesday, November 9, 1983

9:00 am. **Workshop Summaries**

Theme 1 - Dr. Stuart Smith
Theme 2 - Ms. Heather Menzies
Theme 3 - Mr. Roger Blais
Theme 4 - Ms. Jennifer McQueen

10:45 am. **Ministerial Panel**

12:00 pm. **Closing Remarks**

Hon. Donald J. Johnston

CONFERENCE THEMES

First Theme: "Technology in Canada's Future"

"Technology in Canada's Future" incorporated issues such as the significance of technological change in economic development; the important role of technology in productivity improvement; what new technologies are needed for Canada; the diffusion of technology within Canada and how technological change will affect Canada's international competitive position.

Second Theme: "Concerns About the Consequences of Change"

"Concerns about the Consequences of Change" discussed such issues as the possible loss or downgrading of jobs through technological change; the impact of increased productivity on the job market; mismatching of skills and jobs; the question of appropriate education, training and retraining in the changing job market; declining job security; risk to health and safety in new technologies; effects on the home environment; and changes to the form and substance of industrial relations.

Third Theme: "Putting the Technology in Place"

"Putting the Technology in Place" incorporated the issues of developing and using new technologies, along with ways of introducing and diffusing innovative changes within Canada. The role of governments, private industry, labour and academia related to these issues was also addressed.

Fourth Theme: "Adjusting to Change"

Some of the issues discussed in "Adjusting to Change" were whether the existing adjustment arrangements - the social "safety nets" - are adequate for the challenges being posed by new technology; how to provide for groups in the population which tend to be concentrated in occupations that will face significant change; and who should bear the burden of the cost of adjustment.

OPENING ADDRESS

The Right Honourable Pierre Elliott Trudeau
Prime Minister of Canada

Distinguished guests, ladies and gentlemen,

People have a distressing habit of being ill prepared for the future. Whether it be the direction of the stockmarket, the likelihood of an earthquake, the size of the school population, or the fanaticism of a dictator, somehow history seems to record very few instances of man's preparedness. It seems that we are always being caught off guard.

Even when we are warned of impending events, more often than not those events must befall us before the truth of any warning is appreciated. Shakespeare, for one, used this quirk of our nature with great dramatic effect. A ghost warned Hamlet, three witches warned MacBeth and a soothsayer warned Julius Caesar. Still, they soldiered on, and, to no one's amazement but their own, they suffered the consequences. Mankind's characteristic deafness makes great theatre, but it is far from beneficial in real life.

Even when we are able to foresee an event with complete certainty, we often remain unable to grasp its full meaning. The Industrial Revolution, the development of the internal combustion engine, and nuclear fission did not, so to speak, "come out of the blue". True, these developments, and refinements to them along the way, came slowly, but their impact still gives us pause, and we have not yet fully assessed this impact. It would appear that it is a characteristic of the human mind to create all sorts of things without considering the consequences.

Most happily, Mr. Chairman, this conference goes against that tendency. Preparedness for the future is, in fact, the main theme of this gathering.

It is in our common interest to prepare for the impact of the technological revolution, for it will effect changes on our world more profound than any other peaceful movement in history, and at a phenomenal pace.

Some of the necessary adjustments will be strictly at the personal level. Automated banking, automated cash registers in supermarkets, and the fascination computer games hold for our children, for instance, are now facts of life for each and every one of us, and we must get accustomed to them. I am positive that Canadians will adjust without great difficulty to technological changes such as these which touch their everyday lives. However, some other aspects of the technological revolution are so basic that they will shake the very foundations of our social and economic structures.

All major areas of activity are being affected, from agriculture to health care, including manufacturing, communications, energy, fisheries, and mines. And while all groups in our society feel the impact of technology, some feel more threatened than others. This is true of women who work in offices, of young people, of plant workers and of the unemployed.

The federal government is committed to working in an enlightened fashion towards developing policies for the effective management of technological progress and its impact on Canadian society. Of special concern is the impact on women in the workplace, for women have every right to equal participation in our economic future.

The government's approach to the management of change is threefold: first, to encourage the development, growth and usage of state-of-the-art technologies; second, to protect Canadians against any negative effects of that technology; and third, to ensure that all Canadians share equitably in future benefits.

Encouraging the growth of a domestic "high tech" industry is no mean task for our government. It means spending a lot of money — nearly $4 billion this year — at a time when there are many competing claims upon those funds.

But the government must be more than a patron of technological enterprise, more than a source of funding. For even more fundamental is the government's responsibility to help manage the impact of technological change, and to act as an honest broker between competing forces in the movement towards a technologically sophisticated society.

The birth of "high tech" has created and will continue to create winners — successful and rapidly growing companies, but it also creates losers — workers and companies whose skills or products become obsolete. The government's preoccupation must be to ensure that the benefits of this revolution outweigh the costs. We must help establish an industrial climate which fosters adaptation. At the same time, we must be responsible and resourceful in our treatment of displaced workers.

Robots replace welders, word processors replace office workers, computers have taken tasks away from clerks, woodcutters and air traffic controllers. But obviously, automation can also create new job opportunities.

The federal government is attempting to ensure that as many Canadians as possible find work, not lose it, as a result of technical progress. That means new retraining and educational programmes. This year we will spend $ 1.2 billion on the teaching of occupational skills. As well, we are encouraging a climate of co-operation between labour and management, so that decisions to use new technology will be planned and monitored with a view to minimizing harmful results for workers.

In addition to helping to educate Canadians to qualify for high-tech employment, we want to ensure that there are jobs for which to apply. To that end, we have restructured taxation rules to create a simple process of claiming research and development tax credits. This change will bring benefits to industry this year alone in excess of $200 million. As well, we have directly committed $100 million to new technological initiatives over the next two years. Millions more are coming from provincial governments, and municipal leaders across the country are committing time and resources to attracting new high-tech jobs to their regions. The combined effects of these initiatives are bound to stimulate job creation.

That, unfortunately, offers no immediate relief to the woodworker in British Columbia, the welder in Windsor or the office worker in any one of a thousand places who see their job functions being taken over by machines.

The federal government considers it imperative to encourage joint labour-management control over technical change in the workplace. Producing more, and producing more cheaply, are laudable goals — they are crucial if industry is to survive and prosper — but such goals cannot be pursued blindly. They cannot be pursued at the expense of human dignity. In that context, the government wants to engage in further dialogue with organized labour, so that the concerns of workers will be fully respected in the formulation of public policy.

Canada must be both competitive and compassionate. To be both, we must be aware of what lies ahead. That awareness is what this conference is about. It is an important conference for the government. I hope it will be a beneficial one for all of you.

WORLD CONTEXT SESSION

MANAGEMENT OF TECHNOLOGICAL CHANGE: A VIEW FROM THE U.S.

Dr. George A. Keyworth
Science Advisor to the President of the United States, and
Director, Office of Science and Technology Policy

It is a distinct pleasure for me to be here today to address this "Canada Tomorrow" Conference. In addition to the long-standing friendship and close ties between the U.S. and Canada, Canada has long been my adopted second home. Our family retreat on Cape Breton offers me a very special respite from Washington, and an opportunity to replenish my depleted reserves of simple, common sense.

My task here today would have been much easier if I had been asked to explain how to manage scientific research. As a former Director of Research Programs, I know it's really not very difficult to recognize budding talent and to sense what new ideas are the most promising. But I approach my topic today — how to manage technological change — with some trepidation. As I confessed last week to our National Academy of Engineering, science advising is easy but technology advising is difficult. It's difficult because technology in the U.S., with our multiplicity of competing institutions, evolves in wonderfully unpredictable ways.

Successful managers of technology learn to respond to the flow of external events — in this case the evolution of new knowledge and the dynamics of the marketplace.

Clearly, the course of technology is often dominated by factors we may have little control over. The wise manager, or planner, focusses on options for how evolving technology may be used, how its progress may be enhanced, and how we can prepare ourselves to take advantage of emerging developments.

Governments in different countries — and even successive governments within the same country — may exercise their options in quite different ways. How technological change will be addressed depends on the relative roles of the government and the industrial and academic sectors in a country, as well as on the stage of economic development and current state of economic health of a country. What may be effective for Canada may or may not be effective for the U.S. and if we pursue similar strategies today, we might diverge five years from now. At the same time, however, there is a growing consensus among industrial nations that technology is critically important to economic growth and that government must be, above all, responsive in supporting the development of technology.

That means we're expected to learn from experience and observation. So let me illustrate with examples of two government programs and how they affected the course of technology. One has been highly successful, and one has not. Both can teach us something.

We probably can't overemphasize the importance of the announcement, thirty years ago, of the structure of DNA — the molecule that carries genetic information. Following years of increasingly quantitative approaches to biology, the discovery reflected the growing influence of experimentalists who were less interested in whole organisms than in the mechanisms that made the smallest parts of them tick. The result was a vastly expanded horizon in biology that offered, at last, the key to eventually understanding how life is regulated by actions at the molecular level.

This success in identifying the double helix occurred in 1953, a time when the U.S. government was just beginning to build institutions for the support of basic or fundamental research — such as the National Institutes of Health and the National Science Foundation. So as this new field of molecular biology began to grow, those young government agencies gradually increased the amount of support they could provide for it.

It was clear from the beginning that the field was important scientifically. All you had to do was observe the quality and enthusiasm of the young people flocking to it. So for a decade, then two decades, the federal government responded to the imaginative ideas from the laboratory and funded increasingly sophisticated research. The advances in new knowledge were astounding — in genetics, in cell biology, in regulatory biology, in immunology, and in a host of other emerging disciplines.

In spite of the progress being made in those areas of modern biology, practical applications continued to seem a long way off. Certainly they were far enough away, and unpredictable enough, to discourage much participation in the research by the commercial sector,

such as the pharmaceutical companies. But as we all know, that situation changed dramaticially in the mid-1960's. What had been esoteric became practical — if not overnight, then over a very short period of time. Led by the new research technique of gene cloning using recombinant DNA, this emerging field of biotechnology attracted almost a frenzy of commercial interest.

So, for the government, what had been a classic case of management of scientific research changed — and changed quickly — to include the more difficult problems of technology management. Our challenge now is to encourage this commercial development without preempting it, to understand the extent to which some of the ongoing research may now be expected to be picked up by the private sector, and then to continue to respond to other scientifically important research opportunities that may again pay off somewhere down the road.

When government first got involved in molecular biology it was truly frontier research. Only after twenty years of patient support did this entirely new biotechnology marketplace appear. This process — setting scientific directions that may someday result in new technology — is something only government can do, because the returns on investment have to be calculated so broadly and over such a long period of time.

Now let's contrast that government venture, which is a classic example of one that's been worthwhile and productive for the nation and the world, with one that had results as disappointing as the others were exhilarating. The 1973 Arab oil embargo was not a technological development; rather, it was a combination of economic and political events spurred by nationalism among nations who recognized the world's growing dependence on a prime commodity.

In this case the United States' confidence in its ability to direct technological change served us poorly. We relied too heavily on the "if we can go to the moon we can do anything" attitude about technology. We decided, largely on the basis of wishful thinking, that we could quickly develop radically new energy sources through the application of technology. Even if we had been able to, it would have been at a cost that would have made OPEC look like a real bargain.

Unfortunately we committed billions of dollars to accelerate development of new energy technologies — especially synthetic fuels — that had little hope of being economically competitive under reasonable near-term conditions. Moreover, we chased that elusive energy cow with such determination, and at such cost, that we wound up under-investing in far more promising R&D through most of the 1970's.

The eventual resolution of that energy crisis was largely unaffected by any new technology at all. Instead, energy suppliers and users responded to changes in market conditions by diversifying their sources of supply and, in the U.S., took advantage of the free market brought about by price deregulation. By the end of the decade OPEC began to crumble as a major portion of free world supply shifted to non-OPEC sources.

At least in the short term, government attempts to direct technology made little positive impact on what was, and still is, a market-driven supply/demand situation. That doesn't mean the government shouldn't be pursuing new energy technologies for the longer term, but it should recognize the very real constraints that an active marketplace places on the introduction of technology.

I chose those two examples because they demonstrate the extent to which circumstances and opportunities influence government's — or anyone's — chances for success in manipulating the course of forefront technology to expected ends. But the choices are rarely clearcut. Choices in technology development, as opposed to basic research, almost always involve industrial realities right from the start.

I follow two general guidelines in my own evaluation of the role government should play. First, we must be responsive to technological opportunities and must maintain a climate in which they can be capitalized. Government won't intrude when the private sector has enough interest to invest on its own, but we won't let ripe, relevant fields go hungry for long either. This puts considerable pressure on government to choose wisely, because we fully expect the 1980's to offer us more advances in science and technology than perhaps any decade in history. As the ultimate trustee of our national technological strength, government must be aware of and responsive to the opportunities that these advances provide.

Why? Because the free world's economic future and security is so clearly tied to strength in science and its application, technology. In the U.S., we recognize our responsibility to use our science resources to advance knowledge broadly, and we also recognize the advantage to our own economy of being first to develop new knowledge and first to put it to use for economic growth and national defense.

Now as I'm sure you know, in today's world there really can be no such thing as distinct science and technology policies. We have to treat both together — and we have to incorporate them into the larger problem of how to mobilize new knowledge in support of national advancement.

In the U.S. we used to think that knowledge and people would move automatically from the lab to the factory, as if we could simply put pure research in at one end of a pipeline and extract useful technology at the other. In truth, we were misled by the relative ease with which U.S. industry dominated world trade in the decades after World War II. After all, there was little competition to cause us to have to hurry then. But for at least the past decade the competition has been building fast, even if we in the U.S. seemed to have become acutely aware of it only in recent years.

Well, in the U.S. it seems to take a crisis to get our attention. The decade-long shift in trade finally appeared as an "overnight" industrial crisis about a year or so ago. As I'm sure you are aware, there has been strong concern throughout the U.S. that Japanese industries were overwhelming us and there was an advocacy of drastic steps to protect our battered American industries and American workers. That was, to say the least, a gross over-reaction. That rapid embrace of defeatism was hardly what we would have expected from an industrial community that was born in competition and which had led the world for decades. And, in fact, that attitude has now started to fade.

Happily, we see much more clearly today that while many of our industries are being challenged by foreign competition, they're hardly being beaten. And, unlike those panicky times a few years ago, when many of those challenged industries were turning to the government for help, most of them today have rekindled their competitive spirit and are charging aggressively back into the marketplace. They've concluded that the best way to win the race is to run faster, not to try to get the other runner disqualified.

Consider this instructive example from the world of high technology. About three years ago American microelectronics manufacturers were caught unprepared for the rapid expansion of the market for 64K RAMs. Made wary by a recession in the late 1970s, American manufacturers, who were already making 16K RAMs, delayed investing in new production facilities — but the Japanese went ahead. So when the market blossomed suddenly in the early 1980's, Japanese companies had most of the production capacity, and captured most of the initial market.

I remember the articles back then about how American industry would be virtually forced to concede the RAM industry to Japan — and perhaps leadership in microelectronics as well. Fortunately, not everyone believed that. American companies rebounded to claim a healthy share of the 64K RAM market. And, observing their formidable competition, they improved their production techniques as well.

Moreover, the authors of the articles at the time were apparently unaware that even then AT&T was getting ready to produce the next generation of memory chips — 256K RAMs. A year later the phone company was already installing those 256K RAMs in switching equipment in the field. Incredibly, now, just one year further along, a U.S. cooperative research organization is talking about marketing a four-megabit RAM as early as 1986. That's three generations of technology further than the 64K RAM we were so agitiated about two years ago, and to me it's evidence of a superb performance by those American industries that knew full well the difference between being challenged and being beaten. Government intrusion, though loudly urged at the time, was clearly not needed and instead might have had a serious adverse impact on this recovery.

Of course, many U.S. industries are being strongly challenged. That's the reality of our times. That competitive pressure will be unrelenting in virtually all industries from now on, from one country or another — whether it's Canada, Japan, France, Korea, or Indonesia. In a sense I suppose that does mean we're entering a different industrial climate than we've been used to in the past, one in which we have to reorient our thinking from traditional national marketplaces to increasingly international arenas.

In the U.S., with its well-developed industrial research capability, I see two major roles for the federal government. One, as I mentioned earlier, is to support the search for new knowledge. To give you some indication of how important we think this is, we're providing increases in the order of 17 percent this year for support of basic research. Those of you who follow budget politics in the U.S., which is dominated by pressures to cut spending, can appreciate how significant those very real increases are.

At the same time we're emphasizing the development of technical talent — the scientists and engineers who are needed to keep the remarkable twentieth-century scientific revolution going. We feel that in all likelihood our rate of economic growth will be strongly dependent on the supply, and on the quality, of technically trained people of all kinds.

Very early in the Reagan Administration the President made it clear that we had to strengthen our national scientific and technical personnel base. Our first priority was for immediate emphasis on training people in those areas of science and technology likely to have the greatest impact on both industrial growth and national defense; that is, we had to address the immediate problem of enough professional scientists and engineers.

That meant concentrating on university training, and we realized we could quickly capitalize on an existing mechanism that we know works well — the participation of graduate students in research projects as an integral part of their schooling. We're taking advantage of the fact that as a group, American research universities excel — both in terms of producing the new knowledge that stimulates technology and in terms of producing the people who drive the innovative process in society.

So that unique dual function explains our tremendous emphasis on university research. No other research institutions give as much return on investment as universities in the long term — not federal labs, not non-profit organizations, not industry. No other institutions produce both knowledge and people.

I said earlier that we want government to be responsive to opportunities. For that reason, these large increases are particularly focused on the areas of greatest industrial need — physical science and engineering, for example. Over the next few years we expect to see continuing strong growth, even preferential growth, in federal support for university research. This will go a long way toward improving the education of technical personnel in fields with the greatest research activity.

But we also know that some pressing personnel problems won't be adequately addressed this way. Although we've got a good means of increasing the supply of people who get their training in the laboratory, we're far less able to train people in the classroom, and that problem haunts us from the universities right down to elementary school.

In the universities we have critical faculty shortages in fields like electrical engineering and computer science. Over the years teaching jobs in those fields have become less and less attractive to new PhDs because of the active industrial competition for personnel. Young faculty are paid too little, and university research environments are often not as productive as those in industry. As a result, the universities, short of teachers, are severely compromised in their ability to train new people — those very people that the fastest growing industries need most.

These shortages make it difficult to keep pace with the increasing student demand for training in those fields, and it compromises our universities' ability to prepare their students for the rapidly changing technical environment that they'll face in the balance of this century. One thing we know, the industrial world will not be conducted on a business as usual basis, and the firms — and countries — that emerge in a strong economic position will be those that are best at using new technologies to create new industries and to modernize old ones.

Here's an example. Tomorrow's engineers will work in an age in which the ability to use massive amounts of information will have transformed the design process that's at the heart of their profession. The effectiveness of that process — all the way from concept to marketing — will have an important bearing on the health of any nation's industrial technology.

Without doubt the microelectronics revolution is only going to speed up. We can envision today's engineering students, sometime soon in their careers, having the computing capacity of, say, a room-size supercomputer sitting on their desks — or even in their briefcases. Such computing power would give the engineers almost unimaginable new design flexibility and creativity. And there will be a tremendous premium on knowing how to use that capability.

Will our engineers be prepared to take advantage of those tools? In light of our current university faculty shortages, I wonder. It's developments like advances in computers that may have immense impact on technological development — and pose the kinds of problems we can anticipate and should be doing something about.

Well, how do you plan for something like this? One direct step we took this past year was to establish a new program of Presidential Young Investigator Awards. All indications so far are that these flexible research awards will attract and retain outstanding recent PhDs for university research. These are some of the very good people who might otherwise pursue non-teaching careers in industry. By 1989 we'll have reached a steady-state of one thousand young faculty being supported. Just for comparison, estimates say that U.S. universities currently have about 1200 vacant engineering faculty positions.

One of the important elements of that young investigator program — and of other new university and federal laboratory-based research activities — is the involvement of industry. If we expect to do a better job of moving ideas and people back and forth across the boundaries between basic research and its applications, we have to move those parties closer together. Their mutual isolation was another consequence of our country's rapid economic growth over recent decades. With plenty of government funding available for basic research, those scientists and their institutions grew out of the habit of working with industry, understanding their needs — and sometimes even learning some science from them.

So one lesson we're absorbing now is how beneficial a healthy interaction between universities and industry can be. Some of our institutions, of course, have known that all along. In recent years there's been increasing attention paid to how a handful of universities have demonstrated all along that academic research can both achieve the highest levels of quality and also be linked to the industrial world for great economic and intellectual benefit. The proliferation of new, technically oriented industries around Stanford University and the Massachusetts Institute of Technology is no accident. Both developments were stimulated by alert academic communities, and those industries have in turn returned that stimulation to the universities.

Now we also face a larger, less tractable problem than university education. That's the alarming shortage of good — or even qualified — secondary school science and math teachers — the people who are really on the front lines. Because of the highly decentralized and locally independent control of U.S. pre-college education, the only lasting solution to these shortages will be for the public to decide to restore school teaching to a profession of importance. Among other things, that means compensation that would at least permit someone to weigh the alternatives of working as a scientist or becoming a science teacher; it means creating teaching environments in which dedicated teachers have a fair chance to do a good job; and it means recognition.

That's a tough problem, but I think the country is making progress toward those goals. We're beginning to see a groundswell of public opinion and concern for the quality of education — especially for science and math. That's important because, ultimately, any lasting improvements in our education system will have to have that stable and very broad public commitment. So the government — and the nation — is now faced with the challenge of how to capitalize on this growing momentum and to convert it to permanent improvements in our educational system.

I have one more thing I must add about the challenges of managing science and technology. I said earlier that we are in the midst of the greatest changes man has ever seen. And in spite of the difficulty of being able to truly anticipate the future, we do have important choices to make. The unfolding worlds of electronics, of medicine, of plant biotechnology, of chemistry and new materials, and of many others give us unique tools to improve our world. Not only can we continue to create better lives for our own citizens, we can also foresee broad improvements in the lives of people throughout the world. I consider myself to be privileged to have the chance to contribute.

TECHNOLOGICAL DEVELOPMENT AND ITS IMPACT ON THE JAPANESE ECONOMY

Mr. Masahiro Sakamoto
Councillor to the Minister,
Economic Planning Agency of Japan

Technological Development and Economic Growth After World War II

Since the Second World War, Japanese economic growth has been supported strongly by technological development. When we divide the economic growth into the factors of capital stock, labour force and technological development, we can see technological development has made a substantial contribution during the postwar period, while labour's contribution has considerably declined since the late 1960s. Capital stock also has slowed down its rate of expansion since the early 1970s.

The reason why this technological development has sustained such a high growth rate since World War II can be attributed to the following points.

While Japan actively imported foreign technologies, there existed a big difference in the technological level between domestic and abroad. This made the impact on the Japanese economy larger, because the catching up process was more pronounced. Japan did not have old and obsolete equipment, making the introduction of the newest and most advanced technology from the USA and Europe smoother, and the catching up process more rapid.

Secondly, the world economic situation favourably ensured technological advancement for the Japanese economy. A stable and abundant supply of natural resources made the introduction of large-scale American technology easier. Steady development in the international trade and monetary fields also contributed to provide a wider market for the Japanese goods which the growth-oriented policies of western countries encouraged.

Thirdly, however, it should be borne in mind that Japan had the potential to accept advanced technologies and develop them. The aggressiveness of Japanese enterprisers, encouraged by fierce competition among themselves, played an important role in the active introduction of foreign technologies. The existence of a relatively qualitative labour force, engineers and favourable labour-management relations made the technological transfer smoother. A large and expanding domestic market of 100 million people, coupled with rapid economic growth, also contributed.

Finally, the central government had provided a perspective and vision for a future industrial development which encouraged private companies to develop innovations. Preferential treatment in taxation and financial aid and subsidies had been important tools for the technological advance until the mid 1960s. In the 1960s, local governments had been eager to give incentives to the manufacturing sector by preparing the industrial area and improving public services.

The rapid advance in technology and a massive amount of investment expanded the Japanese economy: steel industries formed the basis of a massive production system; petrochemical industries served as a source for new products; and machine industries, electrical industries especially, provided various customer goods.

The strong expansion enabled a substantial increase in employment, compatible with a large gain in productivity, which was directed partly to the decrease in working hours and partly to wage increases. The portion for the wage increase was larger in the Japanese case than in other advanced countries.

Parallel to the improvement in the labour market situation and rise in income, the standard of living has been raised substantially. At the same time, various new products and home appearances brought about through technological progress, made people's lives more abundant and colorful. Around the 1970s, Japan achieved its long-coveted goal of equal partner to western nations.

Trials in The 1970s and The Japanese Response

Favourable economic development in the advanced countries has increasingly been under severe trial since the late 1960s, which had a close relationship with the type of technological advance witnessed during the post war period. Firstly, a strong pressure had been developing on the resources needed for mass production. Since the late 1960s, environmental issues had provoked public concern. The early 1970s saw prices of primary products triple, followed by the first oil crisis.

Secondly, technological development had posed a challenge to the employment situation. Since the late 1960s, there has developed a tendency for business (especially the manufacturing sector) to replace the labour force with machinery, because of the rapid increase in wages and higher fringe benefits (including a growing social security burden in most advanced countries). This labour-saving practice was detrimental to the employment situation of the economy as a whole. While there was less demand for workers, the labour force had been growing, partly because of the entrance of the baby boom generation into the labour market and also because of the larger participation of working women in most advanced countries. The steep rise in wages, on the other hand, exerted pressure on the prices of products in the secondary as well as tertiary sectors, leading to an inflationary development. The first oil crisis aggravated the situation.

In view of the persistent resources problem and inflation of the 1970s, one can say that the market mechanism has not worked well to cope with the issues brought about by technological development and the unfavourable development in the international scene has made the situation more difficult.

During the course of the 1970s, Japan had also been severely affected by pollution problems and two oil crises. There was a difficult adjustment, created by the transition from a high to a low rate of economic growth. As the Japanese economy was more dependent on large scale material-oriented production and overseas natural resources, these difficulties were more pronounced than in other countries. As a matter of fact, the adjustment after the first oil crisis was extremely hard to bear. However, as a result the Japanese economy has developed more resiliency through the trials of the 1970s. The Japanese managed to weather the pollution and public nuisance issues, as many indicators suggest. The economy became less inflationary, as price movement indicates, and more energy was saved as oil consumption fell from 5.3 million barrels per day in 1973 to 4 million barrels per day in 1983. If we compare the profit situation of the manufacturing industries between the two oil crises, we can observe a substantial improvement in the cost structure during the second crisis.

In promoting this kind of improvement, the contribution of technology has been essential. In the early 1970s, active introduction of anti-pollution techniques contributed to abate pollution and overcome difficulties. Furthermore, the efforts of abatement devices sometimes produced more positive results. Japanese automobile-makers manufactured a car which uses less energy with less pollution. Anti-pollution investment dominated 5 percent of the total investment in the early 1970s. Energy-saving is another example of technological benefit. Oil-saving investment tripled between 1979 and 1982, rising from 5 percent to 8 percent of total investment and resulting in a remarkable reduction of oil consumption. Electronic techniques introduced since the mid 1970s have also contributed, not only to saving energy, but also to increasing the efficiency of the economy and improving people's lives by providing new products and services to consumers.

Throughout the 1970s, Japanese technology rose to a level similar with other major technological countries. According to the international comparisons, Japan was lagging behind in the 1960s. However, in the late 1970s, Japan caught up and even exceeded the technical level of other advanced countries in certain fields.

While technology works to increase productivity, if the productivity gain is large enough, the demand for labour force is squeezed by that gain. If the economic growth is not ample enough, the labour market situation would be aggravated. In the case of the development in the manufacturing sector since the first oil crisis, production has increased rather modestly while labour productivity gains have been substantial because of technological advancements. As a result, the number of employed people in the manufacturing sector declined from 1974 until 1979 and recovered somehow afterwards, without exceeding the peak in 1973.

However, as the tertiary sector has absorbed the labour forces, employment has been increasing in the Japanese economy as a whole, although unemployment rose from the level of 1.3 percent in 1973 to 2.7 percent in 1983. One of the reasons which make the Japanese situation different from that of the European and American situations is that Japan had a smaller increase in labour supply, partly because the baby boom generation finished their entry into the labour market in the early 1970s, and the increase of female participation had been remarkable until recently in Japan.

Impact of Technological Change on Employment and People's Lives

According to prospects for technological progress provided by the Japanese Science and Technology Agency, we are facing a new wave of innovation which may even accelerate in the 1980s and 1990s. The nature of the innovation can be expressed by the term, information revolution. Microelectronics will play a key role in this surge. However, progress in other areas such as new materials and biotechnology may create larger-scale innovations.

As in the past the technological development not only contributes to economic growth but also provides new products and services which enrich people's lives. For Japan, technological progress is also essential for its survival since it is a country with poor natural resources. Furthermore, these technologies supply new products and services, which Japan needs eagerly in the coming decades. A lifetime educational system, medicare, social services and ISDN (integrated services digital network) are examples of demands in the coming decades.

So the Japanese government is positive about the introduction of new technologies. However, as these technologies have the potential to replace human labour and intelligence, concern has arisen over their impact on employment, people's lives and international situations.

We shall face a new wave of technological advances in the coming decade, where microelectronization will play a central role.

According to a recent survey conducted by the Labour Ministry and the Economic Planning Agency (EPA), microelectronic devices have been rapidly penetrating, not only the production sector, but also the distribution system, offices and homes. In the production sector, since the late 1970s, numerical control (NC) and machinery center (MC) machines and industrial robots have been introduced actively. However, the adoption of high level robots, flexible manufacturing systems (FMS), computer-aided design and manufacturing (CAD/CAM), is still limited. Sixty percent of the establishments in the survey have introduced microelectronic apparatus and this percentage may shift to seventy percent in the coming two or three years. The introduction of robots amounts to forty percent of the establishments.

The most popular reasons for the introduction were "to improve labour costs" and "to improve the quality and precision of the products", accounting respectively for more than 60 percent of the establishments concerned. In the small and medium-term enterprises, "to cope with the labour shortage" was a predominant reason behind the application. It is reported that substantial changes were required in production techniques in the 70 percent of production processes where microelectronic techniques were introduced. However, only 15 percent of the cases involved old techniques, which were outmoded and unnecessary. A majority of the production processes (more than 60 percent) required new training in addition to the traditional skills.

As for the kind of work, hard, physical labour and dangerous, dirty labour diminished, while work for surveillance, maintenance and preservation of the production process has increased in many establishments. It should be noted, the robots were initially introduced in the processes involving hard labour or unfavourable working conditions, such as coating and welding. The number of workers has been declining in 40 percent of the production processes where MC apparatus has been introduced, while a few production processes are reported to have increased their number of employees. Thirty percent of the establishments experienced a sizable internal job rotation. Few establishments reported having to dismiss workers because of microelectronization. The age structure of the workers tended to shift to younger ones, while the numbers of skilled workers diminished and engineers and technological workers increased.

As for working conditions, most enterprises offered the same level of wages after job rotation and in many instances working hours became shorter. The survey also points out that a strong need existed for new technicians, the efficient use of older workers and retraining educational activities.

At this stage the impact resulting from the dissemination of the Office Automation (OA) is difficult to determine. Employment has not diminished in the offices surveyed which have introduced OA apparatus. According to management, employment was affected more by the economic situation than the introduction of OA. However, it was shown that the number of female workers diminished between 1975 and 1980, while the number of male workers increased during the same period. The impact of microelectronization on employment has not yet been manifested as a serious issue, in spite of the active introduction since 1975.

This raises the question of how Japan has managed electronization without sizeable increases in unemployment. The first answer is that Japan has maintained a relatively high rate of economic growth and the international competitiveness of industrial goods also contributed to ensure the market. Microelectronic technology worked to expand the demand by improving the quality of goods and reducing the cost of the products.

Secondly, Japanese enterprises have positively dealt with the impact of microelectronization on workers with flexible labour-management relations. Instead of laying-off many workers, management has applied active rotation and retraining activities. As well, many labour unions have not strongly objected to the introduction of new technologies and have accepted job rotation and retraining. The sequence for the application of microelectronization — taking place firstly in the pro-

duction processes involving hard labour, dangerous and hazardous operations and simple, mundane work — has made the adjustment easier. Furthermore, in several instances, skilled workers still play a significant role in the process of microelectronization.

Thirdly, as was mentioned earlier, the application of microelectronic technology still remains in the beginning stages, with limited effects on employment to date. While the number of machine tool workers declined, programmers and technicians increased in number. When we divide the tertiary activities into information-related services, business and personal affairs, the most dynamic expansion is seen in the information activities.

Again, it should be remembered that the smaller increase in the labour supply since 1973 also contributed to ease the unemployment issue.

As for future developments: factory and office automation will be more systematized; more sophisticated robots will work in the production process; flexible manufacturing systems (FMS) and CAD/CAM will be in more popular use; medium and small-scale enterprisers will become more active in the introduction of the technology; and electronization will not only proceed in the manufacturing, but also in the service sector.

This development brings, on one hand, more rationalization to the existing production and management process, resulting in more labour-saving and shortened working hours. On the other hand, more expansion is expected to take place in the production of new products and services, creating new opportunities for employment, especially in the tertiary sector.

When we think of the employment situation in the 1980s, labour supply will grow by about 0.9 percent, as it did in the 1970s. However, the numbers of older female workers will grow more rapidly than the average. On the demand side, we shall face a substantial difference in the demand for labour by sectors. In the manufacturing sector, employment will decline in basic material-producing countries, while in the machinery-producing sector, it will decrease. The tertiary sector will produce a sizable increase for labour forces. Information services is expected to expand vigorously, like the growth in the service-producing sector for individuals and business.

Occupationally, the demand for professional and technical workers and management officials will increase, while the demand for workers in production will remain constant.

While the overall effects of these factors on employment is not clear, it is predicted that there will be a slight improvement in the unemployment rate in the 1980s, under the 4 percent economic growth forecasted in the new Economic Plan of August 1983. However, in view of the significant changes on the demand side and the increase in elderly workers and females in the labour force, there is the potential for a sizable mismatch in the labour market. Also, if the economic growth rate is not large enough, a bigger mismatch may emerge, as the pressures on aged and female workers will call for active labour policies.

As with previous innovations, microelectronization has been working to provide better working conditions and more free time, thus enriching people's lives by supplying new products and services. Some typical examples include: ticket reservation, auto-teller bank machines, electronic calculators and photocopying machines.

In the coming decades, with the improvement of information technologies and facilities, extensive changes can be expected to take place in the information network and people's lives. The INS (the Nippon Telegraph and Telephone Public Corporation's information network system), to be completed in the 1990s, will serve as the basis for an information infrastructure, providing abundant and qualitative information to the society.

Supported by better information infrastructures, there will be a substantial improvement in banking services, traffic control, medical information and disaster prevention systems. In business activities, while factory and office automation advance in a more integrated way, international and interregional communications will grow, making the management sector larger. As for working conditions, working hours may decline, while working time would change with flex-time employment increasing.

The introduction of various types of information equipment will transform the home into an intellectual information centre, perhaps regaining importance at the core of social life. Each household may be equipped with a multifunctional terminal which incorporates all kinds of media information, data, facsimile, and video communications and telephone services.

Undesirable problems, such as: a possible deluge of information; invasion of privacy; or, an increase in the vulnerability of social systems may develop. An agenda should be put in place to manage these situations.

In the field of international relations, microelectronization makes interdependence through information spectacularly closer. The exchange of goods, services and information will become more efficient and internationalization will be intensified. This may provide the benefit of better information, but while the exchange of information will increase substantially, the government might sometimes find it more difficult to control the enterpriser and its nationals.

While the exchange may grow, competition in the industrial sector may become more intense. Industrial disputes may develop not only between trilateral countries, but also between newly industrialised and advanced countries. The possibility exists that the discrepancy in technologies may further widen the gap between more and less developed countries.

Policies to Manage the Technological Progress

Technological progress is essential for the development of our industries and economies. It is of great importance, not only in promoting the technological applications currently taking place, but also in encouraging the development of revolutionary technologies and stimulating technological inventions which will form the basis for new innovations. The importance of the latter requirement will grow as Japan needs more domestically developed advanced technologies.

As society matures and aging advances rapidly, technological progress should be directed towards enriching people's lives by supplying new products and services. More consideration will also be needed on the impact of technological progress on the international field.

On the subject of the division of labour between government and the private sector, technological progress has been promoted under the initiative of private companies. Profit-motivated competition is the most powerful force for technological innovation. The role of government should be a supplementary one in the introduction of technology. However, there are areas which cannot be satisfactorily developed simply through market mechanisms.

Basic scientific and technological research in universities; the development of risky and high technologies; large-scale projects such as nuclear, space and ocean development; and technological advancements concerning medical care, social services and hazard prevention are the areas which the government should develop and support. Still the case should be left to the initiative of the private sector when the development reaches a certain level. Government support should consist of fiscalization, and financial aid. The current support is basically indirect and the level is not high when compared with those in other advanced countries. Supports were substantial and comprehensive in the 1950s and early 1960s, but they had completely changed by the late 1960s.

Expenditures for research and development accounted for 2.42 percent of the national income in 1980, lagging behind most advanced countries (2.61 percent for the U.S.A., 2.98 percent for Germany. The current goal of the Japanese government is to raise this ratio to around 3 percent). The expenditure for science and technology shares 3 percent of the budget, far less than the U.S.A. (5.3 percent) and France (5.7 percent).

The public sector has a small share in bearing the cost for R&D (26 percent in 1980), whereas the share is larger in other countries (47 percent in France, 35 percent in the UK). In using the expenditures, the private industrial sector dominates a large portion in most countries. As for cost-sharing, the government sector contributes a smaller part of those expenditures in Japan (27.4 percent in 1979), while in other countries the contribution is larger (49 percent in the U.S.A., 58 percent in France). When we divide the expenditures for R&D into those for basic research, application research and development research, development research has the largest and fastest growing share in Japan. Expenditures for basic research, where universities and government have larger shares, have been shrinking recently.

Areas for Technological Encouragement

Amplifying the foundation for technological development is of great importance: to catch up on the need for technology; to search and foster the seeds for new innovation, to arrange the standards and statistics for new products; and, to encourage basic study and research, which have been neglected.

There is also the need to cultivate human resources for training technology, then advance fundamental and high technology. The government is in a position to support such private initiatives, where the risks are larger, because of the longer lead time and large-scale financial requirements.

Research on optic, laser and huge projects on the development of new energy are some examples in this area. The technologies of the late 1980s or 1990s,

whose development currently lags behind, should be supported. New materials, biotechnology, space and ocean technologies are the other areas where support is essential.

The development of social technologies will also be increasingly important towards the year 2000. Systems for medicare and information medical apparatus, disaster prevention, housing information, pollution control and traffic control are examples in this area. In adopting these systems, technological assessment should be carried out thoroughly.

Technology linked to local development and international cooperation is also very important.

The Side Effects of Technological Development

The first issue concerns the employment problem. It was through the two oil crises that government support was provided at a sizable scale for employment adjustment. In order to facilitate this adjustment, either in promoting retraining and re-employment, or in maintaining employment within the enterprises, the government provided subsidies to the entrepreneur. Support was made especially to enterprises in specific industries and areas, and was also given to encourage the employment of elderly people.

With increasing numbers of aged and female workers entering the work force coupled with structural changes in the demand side, there can emerge a larger mismatch in the labour market. The situation is aggravated when slow economic growth puts more pressure on aged workers. Therefore, policy directions are: firstly, to maintain an appropriate economic growth; and secondly, to make a flexible adjustment for the cyclical change and make use of the technological progress towards facilitating a shortening of working hours. Active working hours. Active support will be needed to facilitate retraining, educational activities and re-employment, especially for the aged and female workers. Public institutions will be required to provide information on the demand for labour. Although working hours will diminish with the diffusion of statutory holidays, there may be a need to further reduce working hours through job-sharing.

Industrial adjustment is another side of the unemployment problem. Several industrial sectors have felt the impact of the two oil crises. Measures have been taken to support such industries and the areas in which they are situated. They consist of: preferential tax measures; concessional financial aid for replacing obsolete equipment, and subsidies to facilitate re-employment.

The industrial adjustment after the first oil crisis was not due to technological development, but to higher oil prices and the rapid decline in economic growth which followed. The adjustment, so far, has been made rather positively. Many companies succeeded in lowering energy costs by introducing energy-saving devices and some are now trying to survive by engaging in other industrial activities.

Technological development accelerates regional disparity. During the course of the 1960s there developed a wide regional imbalance, which was mitigated during the 1970s, through extensive use of fiscal investment.

Recently, a new project called "Technopolis" was launched. Nineteen cities across Japan have been chosen as sites for these projects and are given preferential treatment in fiscal and financial support. These places will have a university with science and technology faculties, high technology factories and skilled labour forces. They would be developed as a technological, economical and high-quality living environment.

Japanese economic growth owes much to imported technology, as indicated in the hugh deficit in technological services transactions. However, the net accounts of new technological transactions has turned surplus since the early 1970s. Based on the number of patents registered abroad, Japanese technology has attained a high level in developing new technologies. This potential should be used to re-vitalize the world economy.

Industrial cooperation and direct investment abroad have been rapidly expanding, not only in developing countries, but also in developed countries. Technical assistance is also promoted eagerly and recent external economic policies have been intended to develop international cooperation more actively.

As Japan has been slow in developing basic scientific and technological contributions, the Japanese government recently concentrated its attention towards encouragement of these areas, by placing more resources in fundamental research. An active participation in R&D projects is an indication of the eagerness of Japan.

SOCIAL EFFECTS OF THE TECHNOLOGICAL REVOLUTION

Mr. Jean-Jacques Servan-Schreiber
President, World Centre for Information and Human Resources
Paris, France

I would like to make a few remarks to this conference, which reflect Canada's role in the world: to lead people with diverse views and different talents; and to consider, creatively and peaceably, the crusade humanity must embark upon if it does not want to be overtaken by the forces of disorder, fanaticism, and war.

First of all, we must realize what has happened over the past few years, in all our countries, in all the countries of the world. The shock produced by the scientific revolution, and specifically the computer revolution, is as powerful as a shock produced by war. It has rendered the vast majority of our factories and machines useless, because they have become obsolete in a matter of months, spelling ruin for each of our societies.

At the same time, it has led to the setting aside of millions — tens of millions — of men and women in the full flight of life, who have been deprived of the opportunity to take part in society and have been left to live — if it can be called living — off society in a state of forced unemployment.

Finally, the same shock has dragged us down even further, if that were possible. The countries of the Third World are today — at this very moment — experiencing the tragedy of bankruptcy. A large country like Brazil, which many of us are familiar with, is on the point of declaring insolvency because its foreign debt has reached $100 billion and it can no longer pay the interest — let alone the principal.

If Brazil, as the experts predict, were to come to that — and it is naturally tempted, since the IMF has already imposed measures that cause its people great hardship — it would trigger a chain reaction in many other countries. The terrible repercussions would be felt in our countries, as the organizations that lent $100 billion to Brazil and $600 billion to the other countries in the same situation are the banks of the industrialized nations of North America, Europe and Japan. We are the ones who lent the money; we are the ones who will suffer. We will share the tragedy of those countries that cannot carry on any longer.

In the past five years our factories, our people and our societies have suffered a shock comparable to the shock of war. Forty years after the last World War we are now faced with the same problem — giving birth to a ravaged world. But this time there is a difference — which I allow myself to point out, having had the honour of being a fighter pilot in the United States Army.

This time the United States has suffered, is suffering, the same ravages as we. The United States is no longer there to launch a plan to pull the world through. There is no one to turn to. The world stands alone, we have to deal with this problem alone and we must solve it.

Is it fate that has brought us to this? My very sincere answer to that question is "no", it is not the result of fate, but rather of sheer blindness.

We have seen the new scientific discoveries, technology, data processing, and automation have produced extraordinary results with regard to production, productivity, the multiplier effect, and the capacity of machines. We saw this production revolution take place very quickly. Fascinated by the progress in production and technology, all of us — in North America, Europe, and Japan — forgot about the other side of the scientific revolution.

This scientific power gave us computers, automation, robots, workerless factories, and the phenomenal changes that have no precedent in the history of humanity. The other side of this science can be turned to good advantage. The same source of strength can be used to train and equip men and women in all countries, whatever their level of skill now — for trades that are more highly skilled, more fulfilling, and more profitable than the ones they are losing.

No country in the world has put forth a public or private effort, using the best scientific instruments available to train men and women for new jobs. This is a collective crime, a case of collective negligence, which we have overlooked too long and which we must begin to correct. This conference in Ottawa provides us with the opportunity to do so...if we do not want the forces of fanaticism and violence to overcome us.

Let us examine the problem. The so-called industrialized countries of North America, Europe and Japan now have 38 million unemployed. The OECD predicts that before 1985 there will be 5 million more unemployed in our countries. I am not talking about the poor countries: I am talking about the so-called rich countries.

The true extent of the tragedy is not apparent in these figures, since they are so large that they are rather difficult to comprehend. In countries like Canada, France, England, and the United States, the unemployment rate in the sixteen to twenty-four year age group is double, or even triple, what it is among adults. Everywhere, at least twenty to twenty-five per cent of young men and women cannot find their first job, and their lives are therefore, from the start, desolate and discouraging for themselves, their families, and those around them.

We are massacring our youth, and this cannot be said too often or too loudly. We are massacring our youth by not giving them — and we *do* have the means — the chance to pursue a creative vocation, and by allowing them to fall into apathy and aimlessness. This problem of educating and training young people in the new skills required in the new society was mentioned recently by two authorities on the subject. The US Secretary of Education, Mr. Bell, said, "We have to get our education out of this abyss of mediocrity," referring to countries whose greatest universities are unrivalled. In Canada, too, you have excellent universities. I can vouch for that, since I sent my own sons to Canadian universities. Last week, the Principal of McGill said: "It is increasingly clear that Canada cannot achieve any economic policy without a new consensus on our educational goals."

Together we must find the energy, that we have so far lacked, to explore the training possibilities offered by the new means science has made available to us.

I know that the French are known for their arrogance, which has done us much harm. There have been many cases in my country where the French sense of superiority, which is unfounded, has hurt my fellow countrymen and often led them to defeat.

I would like to tell you, having made this little historical aside, that for the past eighteen months President Mittérand and the French government, have attempted to take concrete action to launch a crusade of knowledge. A crusade that will lead men and women, not just machines, to take advantage of science, that will, once again, give people and their children a fulfilling life now and in the future, bringing them out of their despair.

First of all we examined how computers could be applied to the widest areas. We questioned whether fifth generation computers, which we call artificial intelligence, will be able to contribute and have a multiplier effect on production in all the countries in the world. Throughout the summer, President Mittérand held meetings with several ministers and teams of French scientists, specializing in computers and artificial intelligence.

The conclusion we reached was that immediate action was required, over the next two years, to use expert systems of production, like production-multipliers and economic cost reducers. We in France must reduce costs in three particular areas: health, agriculture, and education.

It is surprising when a so-called rich industrial country like mine (France is among the six or seven countries with the highest standard of living in the world) attacks its most serious problems, the three main fields of priority defined by the French President and all the French experts — education, agriculture and health. These priorities are the same for the whole world and, consequently, we already see emerging one of the great truths that will dominate our work beginning early next year.

There is no longer north and south, nor industrialized and developing countries. The industrialized countries are ravaged, their instruments of production obsolete, and their people illiterate in the new language of the computer culture, which is a must for everyone.

We are all on the same footing, and therefore we must work together to carry out the great crusade of knowledge in providing enough food for everyone; transferring knowledge; and, developing the capacities of all persons — no matter what continent they live on, no matter what their cultures are — so that they can exploit their creative potential. This means not just finding a job to earn a living, but finding a job that puts all one's abilities to use and provides an opportunity for full development. It means having the hope that children will be able to use their intelligence for future activities.

The priorities are the same for the north and for the south, for east and west. We must act now. Major industries based on the transfer of knowledge by means of computers and artificial intelligence are within our reach.

If we take the example of French research laboratories (and we are not in first place in the world; we do not have enough people or equipment) the indispensable hardware is still made up of big American computers. We take the latest and most advanced equipment because, at the present time, we are not interested in making progress solely from the point of view of public and political power. Industry will make its money and its profits, since the electronics industry is assured the highest profits and the fastest growth in the world. What interests us is to train people, not create machines.

The aim of the World Centre, which was set up eighteen months ago in France and which I head, is not to train machines, but to train men and women, of all ages, of all cultures. It is a centre where fifteen nationalities are to be found. It developed quite naturally because the demand is great in the fifteen countries, as well as various regions of France, where other centres have sprung up. In fifteen countries there are similar centres affiliated with ours, and we receive weekly calls from every region of France asking for the computer culture to be made available to the people of the regions.

Forty years ago, the Marshall Plan was a success in its field. It brought the world thirty years of growth — I am speaking about the industrialized world, the north, the world of prosperity. Our task today is a hundred times greater. We are not dealing with simply one small part of humanity, made up of the industrialized countries of the north, but rather, with the whole world.

If, through blind indifference, we were to allow the countries of the Third World to go bankrupt, our own growth would immediately suffer and fail. It is inconceivable that America, Japan, Canada, and Europe could sell the same products to one another in such a small market. It is clear that we must create a world market together: we must give the impoverished countries of Africa, South America, and Asia — all those that at present do not have the means to live and therefore even less the means to buy the products of science — the means to live comfortably and the means to purchase goods.

The new world plan will not be a financial plan, like the Marshall Plan was in its time, but a plan for transferring knowledge and know-how. The goal of creative capacity for everyone is within reach as early as 1984. If all our laboratories and universities were to work together — interconnected by the vast data processing networks that already exist on the earth, in the air, by satellite, and by electronic mail — we would be able to collaborate on the same research at the same time.

Just imagine if we were to take the effort we have just organized in France, with eighteen laboratories in our various regions, and multiply it by the Canadian capacity, the Japanese capacity and the American capacity — imagine all the laboratories, all the teams, working on the three major priorities together!

The challenge is to create systems that can be used industrially to provide the means to ensure that people will not lack food, education, or health care anywhere in the world. Let us not talk of the year 2000. By then it will be too late. It is possible in the next three to five years to achieve these goals. It is now that we are going to win or lose, and now is when we will realize that we have the means to win. This is what is ahead of us; this is what we are capable of, if we simply acknowledge it. Who would imagine that a man or woman in Ottawa, Paris, or Pittsburgh would expect us to have the means, by giving creative hope to everyone in the world, to fight against the forces of fanaticism and of war that threaten us? Who could conceive that, having realized this, the man or woman would not find the firm willpower to fight and win? Their children — you and I both — would remind them forcefully every day.

Thanks to you, we will win. This victory of life, which we can make more stimulating, more fascinating than any military victory — we can work toward it, thanks to you. And I thank you for the effort you have made by gathering here today with us in Ottawa.

PANEL DISCUSSIONS

PANEL NO. 1: INTRODUCTORY REMARKS

Dr. John Evans
Chairman, Allelix Inc.

This afternoon's session will build on what you have heard this morning. We've had an international context for the development of technology which has stressed: the scope of the changes; the profound nature of the changes which we can expect with the technologies; and, the speed with which these changes are taking place.

The subject areas which we have been invited to address in the first round table are: "Technology in Canada's Future" and "Concerns About the Consequences of Change". All of which is to be dealt with succinctly in 90 minutes.

The background paper prepared by Douglas Fullerton provides an excellent framework for this discussion and I hope the members of the audience will look carefully at that more comprehensive treatment of this discussion.

It's our pleasure now to listen to four individuals who will bring different aspects of these two subjects to your attention. I shall begin right away, in order to conserve the maximum time for discussion, by calling on Dr. John Madden, President of Microtel Pacific Research. Dr. Madden will begin by illustrating the potential achievements of some of the new technologies and, perhaps, solutions to some of the problems that are presented by those advances.

Our next speaker will give the industry and business point of view. Mr. Guy Saint-Pierre is the Chairman and Chief Executive Officer of Ogilvie Mills Limited.

Our third speaker is James McCambly, President of the Canadian Federation of Labour. Mr. McCambly will address the critical issues of the impact of the new technologies on employment and the potential impact of workers on the productivity in technologies.

Our final speaker is Dr. Margaret Fulton, the President of Mount St. Vincent University. Dr. Fulton will raise our consciousness about possible adverse social consequences of the new technologies.

CAN WE COPE WITH THE CHANGES CONFRONTING US?

Dr. John C. Madden
President, Microtel Pacific Research

It is clear that the challenges which technology poses are not unique to Canada — they are challenges for mankind everywhere. Tomorrow's Canada will depend, most importantly, on the ability of our global society to adapt successfully to the changes which these technologies imply and only secondly on the success of Canadians, relative to peoples living elsewhere, in adapting to these changes. Perhaps, in solving its own problems, Canada can provide a model for others to emulate. Few today would look to us for such model behavior.

The opportunities and threats which we all face can largely be laid at the door of three key technologies, namely:

(a) nuclear science, whose threat and promise need no comment;

(b) biotechnology, which shows great promise in medicine and agriculture, but which carries with it the somewhat eery possibility of tinkering with our own genes; and, lastly

(c) microelectronics, which has already raised our *average* standard of living in countless ways, but which, with its inherent ability to emulate many aspects of human intelligence, brings with it not only the current threat of job displacement, but also, in some vague way, the threat of "human mind displacement" as artificial intelligence gradually proves superior to our own in one mental activity after another. This process started with simple addition and multiplication, but has moved on to a variety of tasks such as machinery and process control, traffic control, and increasingly, weather prediction, language translation, economic forecasting, warfare and visual pattern recognition. In the not very distant future we will be literally carrying on conversations with computers, a process which is likely to alter fundamentally our perception of their friendliness and reliability, while at the same time making computers much easier to use.

In my comments today I shall try to give some perspective to the last of these three technologies — microelectronics. I shall then go on to suggest that in the current prevailing atmosphere of uncertainty engendered by the rapid changes these three technologies are bringing about, we might better spend our time debating whether our social organizations have the necessary flexibility to cope with our complex environment and the major changes taking place within it, than in debating specific measures to remedy today's ills.

We are told that *homo sapiens* have existed, essentially in our current form and with the same brains we now possess, for approximately two million years. Before that, there was a progressive enlargement in both the size and the capabilities of our brains over a time span of hundreds of millions of years. Yet the computers which are at the heart of developments in artificial intelligence were not born until the 1940s, and the first microprocessor on a chip became available as recently as 1971. Shortly after the Second World War, it was estimated that twelve computers would be adequate to satisfy total U.S. demand. Today manufacturers routinely buy microprocessors for as little as $2 each for incorporation in cameras, clothes washers, cars and calculators. The rapidity of development is staggering, even today, accustomed as we are to a space age vocabulary of superlatives. The very complex tasks of human speech recognition and of visual pattern recognition (which in humans use very large volumes of our brain) require much more computer power than that of a camera's microprocessor, yet the cost of the much more complex computers required for such tasks continues to fall by roughly a factor of two every twenty-four months.

It is very difficult to draw comparisons between the capacity of the human brain and its microelectronic counterpart, not only because the field of microelectronics is advancing so quickly, but more significantly because we do not yet really understand how the brain works. In such circumstances it is a rash man who attempts to compare the two. I am going to be a little rash today since it seems to me to be important, however imperfectly, to have some feel for the progress of artificial intelligence towards matching and surpassing our own, and to have some feel for the rate at which we are approaching what used to be the dream of Utopians — that is, the great age of leisure where machines do

most of the work. Today we seem a little less sure than last century's Utopians that the age of leisure is indeed what we want.

Speed. Our brains work at a snail's pace compared to the speed of a modern computer, somewhere between ten thousand and a million times slower — hence the great speed advantage of computers in carrying out arithmetic calculations. However the computer's speed advantage is somewhat offset in many applications by the fact that a human brain performs many operations simultaneously. It has been calculated that the average human memory cell is connected to about ten thousand of its fellow cells, thus permitting us to rapidly associate in our minds seemingly unrelated events. Most computers, in equivalent circumstances, would have to address each of their corresponding ten thousand cells one after the other, thereby largely nullifying their speed advantage over the human brain for tasks of this nature.

Capacity. The human brain is thought to contain about 100 billion nerve cells. However there is clearly not a one-to-one correspondence between nerve cells and the basic unit of computer memory (the bit), since different nerve cells in the brain perform different functions, and, unlike the computer memory bit which has only two states (0 or 1), many nerve cells are capable of a variety of different states. On the basis of available evidence though, it is probably fair to say that the human brain still contains about a thousand times more memory than is readily accessible in a large commercial computer installation. However, there can be little argument that the computer's memory is very much more stable and accurate than ours.

Already the computer far exceeds our capacity for accurate and tireless calculation. Hence its application in calculators, weather prediction and the running of machine tools. Computers can also interpret data rapidly and reliably, provided the range of incoming information and the resulting decisions to be made by the computer are predictable by the human being who writes the computer program. The launching of spacecraft and the AWACS military command and control system are examples where the majoirty of decisions appear to be made by computers, while human monitoring and, if necessary, intervention is provided for in case the "unpredictable" comes to pass.

Our social and political system is still run by humans, though perhaps with more computer intervention than we realize. For example, large computerized econometric models of our economy are routinely used by governments, financial institutions and others as a basis for economic decisions. Yet these models, which can consist of literally hundreds of equations, each equation describing how one part of the economy is likely to react to changes elsewhere, are normally built by a wandering band of economists, some of whom leave behind little or no record of the assumptions they have built into the particular equations for which they were responsible. Partly for this reason, and partly because these models are simply too complex for full human comprehension even in the best of circumstances, those using the models are left with the knowledge that while on average they will make better decisions if they use the model than if they do not, from time to time the model will be seriously wrong.

The problem, of course, is to know when the computer model will be seriously wrong. The same problem occurs where evaluation of human predictions is concerned, but over the years most of us have developed an almost instinctive sense of when we should trust advice from our fellow humans. We have no corresponding instinctive sense for computer-given advice.

As computers become more and more a part of our daily lives (for example in calculating our income taxes, predicting the profitability of a firm, telling us when to plant, fertilize and harvest our crops and telling us whether mortgage rates will go up or down), you and I will more and more have to face this basic conundrum of computer- assisted decision making.

It would seem however that we are still a long way away from matching in computers our own brain's ability to constructively associate seemingly disparate information, its capability to perform abstract thought, its ability to enjoy a sunset or a work of art or to get angry or fall in love. Experts tell us though that none of these properties of the human brain is incapable of emulation in a computer. My guess is that it will be at least several decades before computers will be relied on to select works of art for an exhibition and, even if it does happen, I am not sure what it would mean for two computers to fall in love!

The advances in microlectronics and artificial intelligence I have just touched on are but one important example of the quickening pace of technological development. It is abundantly clear that we are living in a rapidly changing world, and that change, in and of itself can be and often is, threatening. The problems which technology raises for us cannot be solved by the simple application of union solidarity, money or laws and regulations. They require a consensus on the nature and

severity of the problem, and almostly certainly, a common resolution to work together to implement the agreed-upon solution.

All of us, from time to time, long for the "good old days" when a person could make a decision without consulting everyone on the block. However good those old days might have been, they have certainly gone. The very interconnectedness of our society virtually dictates consultation and cooperation. We could not sustain our current standard of living without it.

If I were able to choose the direction of debate at this conference, I would ask that we not debate whether money or regulations should be applied to this or that problem, but rather, that we ask the more fundamental question as to whether the adversarial system which forms the basis of our parliamentary and labour-management decision making systems is capable of coping with the complex issues we face today.

Adversarial systems, by their very nature, lead to simplifications and a packaging of issues and arguments designed for emotional appeal. Cooperative forms of decision making leave much more room for rational analysis of winners and losers, and the introduction of compensating measures so that better solutions have a higher probability of emerging.

Yet all social systems are adaptable. Our own political and union-management processes already provide significant opportunities for cooperation within their adversarial framework. Can they be further adapted to cope with the change we face? I do not know the answer. I do know that it is easy to become habituated to the sterile (and often puerile) debate in the House of Commons and the mendacity and bitterness which so often accompany labour-management relations, and to accept these as simply a necessary part of a system which cannot reasonably be improved.

Is it true? Or are these symptoms of an evolving social organization which is doomed to extinction?

Konrad Lorenz, the Nobel prize winning ethnologist, described an interesting case of animal adaptation in one of his books. The male Argus pheasant has developed very beautiful and large wing feathers for the sole purpose of successfully attracting females of the species. The male birds with the biggest and brightest feathers are the most successful at mating and hence promoting species survival. The problem is that through natural selection the feathers are now so large the poor birds can scarcely fly, making them an easy prey for predators. As a result, the whole species is threatened with extinction.

Our own adversarial systems provide ample opportunity for many males of our species (and an increasing number of females) to strut their stuff, but there is no necessary correlation between this exercise and making the correct decisions on the actions we need to take to ensure our survival.

In British Columbia we currently have the spectacle of a government and union leadership which agree on the fundamental goals of full employment and prosperity, but which all too obviously disagree on the best way of achieving those goals.

It is easy to curse one side or the other in this dispute (and perhaps easiest of all to curse both sides) for the undoubted suffering and hardship which are resulting. It may be more constructive to question the structure which allowed the situation to happen.

Twenty years ago, American management techniques, which in their day were less feudal and authoritarian than those practiced elsewhere, were widely believed to be the secret of American success. More recently, the Japanese have become the byword for enlightened management as they applied newer cooperative mechanisms such as quality circles to industrial management. It is my contention that the need for innovative organizational mechanisms to promote cooperation and defuse conflict is accelerating in parallel with the rapid pace of technical developments.

Radical as it sounds, we might do well to listen to the tongue-in-cheek remark of Dr. Robert Bell, the retired principal of McGill who recalls once saying to a complaining alumnus (who thought that trouble making professors should be fired) that rather than try to make universities more business-like, we should instead make business and politics more university-like!

TECHNOLOGY IS A COMPETITIVE WEAPON

Mr. Guy Saint-Pierre
President and Chief Executive Officer, Ogilvie Mills Ltd.

Good morning, Ladies and Gentlemen.

I have been asked in the space of about 15 minutes to give some of my own thoughts about the first two themes of this conference. The first theme is the role of technology in Canada's future and the second is the consequences of the changes which that technology will bring about.

I thought the best way of organizing my own thoughts was to try and capsulize some of the important features of technology in our society and our economy today. When I applied my mind to this exercise I came up with these four headings: technology has no nationalism; technology is a competitive weapon; technology applies to process as well as product; and technology is exciting — and frightening.

Let me deal first with the fact that technology has no nationalism.

We are not going to invent everything in this country. Luckily, no one else is going to invent everything either. We must buy it, lease it, license it or otherwise borrow it if we cannot create it ourselves. In short, access to foreign technology is of supreme importance, and here Canada must recognize its inherent advantage in having so many foreign-controlled firms operating in the country. The transfer of technology between a foreign parent and its Canadian subsidiary gives Canada a unique advantage in many respects.

But what about the development within Canada of new products and new processes? Over the last 20 years research and development intensity in Canada has fluctuated over a surprisingly narrow range, accounting for between 1.0 and 1.5 percent of the total Gross National Product (GNP). This is considerably less than that of our other major trade competitors. In all developed nations, Canada included, governments contribute significantly to support industrial R&D. In addition to special tax treatment, governments can offer a variety of non-tax mechanisms to support technological innovation such as research grants, contracting out of government R&D, procurement and so on. Our research indicates that total government support (that is, tax and non-tax support) for industrial R&D in Canada is considerably less generous than that available to our competitors.

My conclusion, then, is that public policies in Canada should recognize and support the facilitative role that multinationals can play in the transfer of technology and that the Canadian government should increase its support of industrial research and development.

You will remember that I said that Canada must lease or licence or buy or borrow foreign technology. The corollory to this is that developing countries can do likewise. They can buy or rent the same micro-chip or robot that we can. And so I come to my second heading — Technology is a competitive weapon.

This was certainly recognized by the Canadian Manufacturers' Association in its 1982 reference paper, "Competing in the Global Village". Let me read what that paper says is a key trend for the future:

> "...comparative trade advantage increasingly means doing things smarter and using sophisticated technology. This is not a secure advantage. Expertise and technology cannot be contained within national boundaries and they rapidly evolved to render yesterday's advantages obsolete. To keep a step ahead of their competitors, industrialists must pay continuous attention to improving their technology management. For companies where managers understand this, technology will provide the key to an effective competitive advantage."

We are observing that newly industrialized countries with their low wages, easy access to technology and descending tariff barriers are becoming formidable competitors in manufacturing and resource sectors that, up until recently, have been areas of Canadian strength. These newly industrialized countries are affecting all developed countries and forcing them to shift into more knowledge-intensive industries and to make more effective use of technology to remain competitive in their *mature* and resource industries.

The fact is that if Canadian industries do not advance their use of technology they will be left behind.

A process of international specialization of production is under way. As part of this process, there have been substantial shifts in comparative advantages as the most efficient places for the production of an increasing number of high-volume, standardized products are the newly industrialized countries. The developed countries, Canada included, will find it increasingly necessary to utilize the skills and knowledge of their people to produce goods with sophisticated technology.

Although Canada is one of the richest countries in the world in terms of natural resources, the importance of human resources is emphasized by the European Management Forum when it says:

> "The industrial countries cannot rely on their natural resources to secure comparative advantages in world markets. Their competitiveness has come to depend on their technological innovativeness, management skills, speed of reaction and willingness to forge links abroad to seek new forms of co-operation. Competitiveness has thus come to depend crucially on human skills— the success of such resource poor countries as Japan and Switzerland is proof of this."

Let me be clear. Natural resources will continue to be a source of enormous advantage and wealth for Canada: But vis-à-vis the developing world, we must recognize that our riches for the future will increasingly lie in our *human* resources.

Please note that I said Canada will find it increasingly necessary to utilize the skills and knowledge of its people to produce goods with sophisticated technology. It is the technology, and hence the people, skills and training, which is sophisticated — not necessarily the product. This leads me to my third heading which is — Technology applies to process as well as product.

Here, my point is a simple one. I do not believe that Canada will stop producing cement, textiles, steel and other basic industrial products. What is happening is that the micro-chip revolution is sweeping the textile, the steel, the automobile and all our basic industries. These industries are becoming in their own way "information based" as they become automated by the micro-chip. By upgrading their industrial production processes the micro-chip increases the international competitiveness of these industries.

Those who speak of a service-based society are misleading us when their comments suggest we prepare ourselves through education and training for delivering services rather than producing goods. In making such suggestions they overlook the extent to which the service sector is a supplier to the goods-producing sector. A recent analysis by Statistics Canada shows that for every three jobs created in manufacturing there is one in services, one in resources and one in manufacturing supplies. Services such as accounting, legal, advertising, transportation, communications, information processing, etc., are to a great extent dependent on the goods-producing sector as their customers. Consequently, in considering the future knowledge and skill requirements of our people we should keep in mind that we will be continuing to produce goods for export and for home consumption which will incorporate and utilize new technologies in their function and production.

The last heading I want to deal with is — Technology is exciting — and frightening!

In a recent report, Canada's Economic Council said something I think is quite startling. It said:

> "In the absence of any other source of growth, an apparently modest rate of technical advance of one per cent annually, on average, will enable a grandson to become twice as well off as his grandfather, in the same job and with the same degree of effort. An average rate of two per cent will make him twice as well off as his father. On the other hand, without technical advance, growth is likely to be very slow — even non-existent according to some — leading to a static society akin to that which is commonly perceived to have existed during the Middle Ages."

I think history can teach us something here. Perhaps the best historical example of the benefits from increased use of labour-saving machinery is the Industrial Revolution in England. Rallying behind a General Ludd, bands of English workers took part in machine-wrecking riots between 1811 and 1816, because they believed that the machines would take their jobs. By 1821 when the retooling process was completed, and all the major mills were using the Hargreaves jenney, output per man-hour in the textile mills had increased two hundred fold. The important point is that jobs weren't lost...they increased 3.5 fold.

And what about computers? In 1971, clerical employment numbered about 1.3 million and by 1981 it had nearly doubled to 2.2 million. As so often happens, the new technology made possible new work that previously had been impractical. Furthermore, the computer created a whole family of new occupations such as systems analysts and programmers and created new industries all resulting in new employment for thousands of Canadians.

I think we have every reason to look forward to the future with the expectation that there will be a net increase in jobs. It always happens with technological revolutions. But we must be realistic. There will be job dislocation unavoidably and an urgent need for retraining and relocation. This is what can frighten others.

This is a very large subject and will be dealt with more fully tomorrow. Suffice it to say that I believe management has a paramount responsibility to demonstrate sensitivity to these legitimate concerns about job loss, retraining and relocation. I can't think of a better summary of my views that this statement from "Competing in the Global Village":

> "Employees need to accept that they have a stake in the company using new technology and to accept responsibility for doing things smarter. This will often require convincing unions to accept the need to improve productivity. Providing greater job responsibility, sharing benefits of increased productivity and improved quality, and retraining displaced employees will help achieve this and would also usefully cement the bond between the company and the employee."

If Canada's future comparative advantage of human resources is to be realized, then labour, government and management must co-ordinate their efforts to adjust to technological change. But I believe management must lead in this effort.

I guess it is obvious from my remarks that I regard technology as a very important means to improve our industrial competitiveness — provided it is managed well. The fact is that we really have no alternative. Technology is easily available to all our competitors whether they are in the industrialized or the newly industrializing world. If Canada is to grow then I believe its goods and its services must be internationally competitive.

The challenge for Canada is not only to find ways of riding the current wave of technological innovation but, given that the rate of change is accelerating, we must also find ways of remaining on the leading wave of technological innovation. Labour, management and government must work together to achieve this result.

UNIONS AND TECHNOLOGICAL CHANGE

Mr. James A. McCambly
President, Canadian Federation of Labour

Let me say right at the beginning that technological change — and the increased productivity it often brings — has, on the whole, been good for Canadian labour.

As I say that, I can almost hear the sceptical questions that many unionists would belt out on hearing that comment: What? Are you crazy? Isn't technology the ultimate threat? They have a point, of course. Technology does pose many difficult problems for workers, unionized and non-unionized, in every economic sector. I want to look at some of those problems later in my remarks. But it is important first to remember that technology has played a large part in achieving the standard of living we now enjoy.

Increases in productivity have meant, among other things, a shorter work week (down from 60 or more hours to less than 40), longer vacations, better working conditions and better wages. The technologies of the future could offer an extension of that trend. We could be looking at the twenty hour week or the three month vacation — without loss of income.

I think that there are three "keys" to making that possible for all Canadian workers — without also creating the miseries of abrupt job displacement or high unemployment.

The first key is the early adoption of broad goals shared among labour, business and government. Some will be labour's traditional goals — things like:

- — achieving full employment for Canadians;
- — improving the standard of living for workers;
- — ensuring that Canadians work in clean, safe, humane work places; and
- — achieving the assurance that increased wealth generated through labour's participation in and support of productivity increases will be fully shared by working people.

Other goals to be accepted by all will have to reflect business's needs:

- — the encouragement of productive practices that can make Canadian industries fully competitive in world markets;
- — support for technological change and innovation in ways that will have minimum adverse effects for people; and
- — the generation of increased wealth to be shared within individual companies and within the nation as a whole.

Agreeing on shared goals and working positively to achieve them promises to eliminate the procrastination, the false starts, the disagreements and the confrontations that constantly interfere with the growth and smooth operation of our economy.

The second key to shared prosperity through technological change is much greater co-operation between labour and management in planning and implementing technological improvements at specific job sites. Management in some sectors has paid lip service to the inventiveness of individual workers through various "suggestion box" schemes. What is needed is a very much more sophisticated and all-inclusive approach in which labour's input is sought — and heeded — as a matter of course. We need deliberate involvement by labour in not only adjusting to technological innovation, but in shaping that technology at the outset, and in modifying it over time.

To repeat, I am not talking about token involvement. Labour must have early access to all of the facts and must have a substantial share in decision-making power. That would be a considerable change from the present. But the returns to business would also be substantial: a well-organized, stable workforce; world-class craftsmanship; improved product quality; higher productivity; and improved profitability.

These are the things that really give a company, or a country, its competitive edge.

The third key that I see to the implementation of technological change in a way that benefits workers is the pursuit of economic development and expansion to ensure that short term job losses as the result of increased productivity in a particular industry aren't compounded by losses across the economy due to stagnation and recession.

You see, displacement — in itself — could be a manageable problem even in times of rapid change. What would make it manageable — what has made it manageable in the past — is the availability of alternative jobs. If there are three jobs for every person, displacement isn't a worry. But if there are three people for every job, displacement is just another word for unemployment. For that reason, we must expand sectors in which we already excell, and identify promising new sectors. A healthy economy is the best guarantee that there will be other good jobs to go to for those who are temporarily displaced.

Those are ways in which the benefits of increased productivity through technological change can be fully shared by Canadian workers. The fact remains, however, that many workers fear new technology and are inclined to resist its introduction. Why is that so?

The prospect — or confirmed fact — of the obsolescence of familiar industries and trades has been shattering to many of us. This has been compounded by other blows to our expectations for a secure, rewarding future. Recent factors of this sort include: massive unemployment, erosion of real income, and wavering commitment by some governments to the social programs most important to labour.

In that light, it is hardly surprising that labour should be largely resentful, even fearful, of change. Part of the present hostility towards technology can probably be attributed to those shaken expectations.

There are other concerns, too. I would like to take a moment or two to itemize the most important of them, first as a way of indicating that the concern about technology is deeply rooted and, in some cases, well founded, and second to pinpoint some of the areas in which we should be searching for solutions.

Almost as important as the concern about unemployment is our concern about job displacement, especially as it affects workers in mid-career. Learning a new job, a new trade, is demanding at the best of times. If the shift is abrupt and poorly planned, it can be a tough psychological blow. The people who plan technological change are sometimes isolated from this human drama. But unions, as fraternal organizations, are close to the hardship it often entails, take it very seriously and are inclined to oppose it unless changes take place with full prior understanding and agreement. Planning must include provision for displaced workers — retraining, relocation or other measures in order to reduce hardship to a minimum.

Also high among our concerns is the tendency of some technologies to dehumanize working conditions — physical and psychological — on the job. The problems can include quickly-paced machines that place superhuman demands on people, isolated stations that cut workers off from contact with their fellows workers, and poorly designed machines that pay little heed to the physical comfort and safety of their operators.

Even more objectionable are the monitoring systems more and more often used to minutely measure the efficiency, and monitor the honesty, of individual workers. A job has to be something more than rushing to carve seconds from a quickly-paced routine. It has to be more than living with the knowledge that any movement may be watched and recorded. These systems rob workers of their privacy and integrity and, in doing so, raise a host of moral questions.

Related to the concern about conditions is concern about the increasing gap between skilled and unskilled jobs. Technology replaces the more monotonous production line jobs. At the same time, society generates increasing numbers of jobs outside of industry that operate at the lower end of the job market. The result is a somewhat larger number of skilled technicians at one end of the spectrum, and a greatly expanded pool of unskilled labour at the other end, with little in between. The result is a widening gap between the responsibilities, and income, of the skilled and the unskilled.

Even the technicians, who must initially acquire complex knowledge about the systems they control, can spend much of their time in a deadening routine. Nothing much happens in a highly automated plant until something fails and all hell breaks loose. It's tedium periodically interrupted by panic. Such situations are intensely stressful with great potential for physical and psychological health problems. As a society, we have a lot of thinking to do about the content and structuring of jobs in a technological environment.

In addition to the specific concern about job changes within the industrial sphere, there are general uncertainties about the future of work in a world of sweeping technological change. Could it be that the very definition of work will change?

In the traditional way of seeing things, unions represent "workers" — men and women who produce something, or provide a service in support of production. In the world we are soon to encounter, a world where there are more people but fewer jobs related to production, we, as a society, may have to consider pay-

ing people for what is not now generally considered to be work.

Many of the activities that may qualify for redefinition as work are those that currently operate in the volunteer, educational or recreational spheres: assisting and comforting the elderly; coaching junior sports teams; raising money or performing services for non-profit enterprises; participating in citizens' committees. Large numbers of people in Sweden already make full or part-time paid careers of such activities. Paid leave for continuing education or retraining — already a necessity in some fields — also falls into this category.

Redefining work in this way would have major implications for society. There would be huge new classes of workers with very different profiles and needs than in the past. Would unions — or any existing representative structure — be able to meet their needs?

We are very concerned about the implications for income distribution of a technological shift that promises to rapidly place much greater wealth in fewer and fewer corporate hands. What would it mean for our society? If many people will find their work outside of traditional workplaces, who would pay them? Our society hasn't yet come to grips with that question. The general answer is this: the machines would have to pay — the machines that have created large pools of new wealth while eliminating many traditional jobs. The problem is in choosing an appropriate mechanism.

Will the redistributive mechanism simply be the marketplace — a marketplace that would undoubtedly offer better goods at greatly reduced prices, to the benefit of us all? Where competition is fierce domestically and internationally, that will probably be the case. But what of monopolies that can keep their prices high? Or what of businesses that keep their prices steady — but greatly increase profits — by reducing the demand for labour? Where will their profits go?

Will the mechanism be taxation or profits? This would certainly help to "net back" a portion of the gains. But, as profits can be used in so many ways that avoid direct and immediate taxation, this would appear to be an inadequate policy tool if used alone. Might there be something like an economic "rent" on new machines that threaten to displace workers or to eliminate potential emloyment? Could that "rent" be earmarked for a special fund that would support displaced members during periods of transition; create new enterprises; and support educational, social and other services provided by unions operating in the affected sector?

When wealth is created by developing and exporting primary resources with little labour input or value-added processing, should we insist on creating additional wealth for our country by taxing those exports? Might we do the same for basic industrial products like ingots? Should this money, too, be earmarked for a special development fund in support of new industrial development in Canada?

Income redistribution may turn out to be the critical issue in the whole debate over technological change. Our society must develop workable, equitable methods of distributing the profits from technologically-enhanced productivity. Somehow, the new wealth must be made to work for us all.

Returning to my original point, my colleagues and I in the Canadian Federation of Labour are not enemies of technological change. We have our concerns. We can also see potential benefits. The fact that we live in Canada is, of course, a tremendous advantage. To begin with, we already have the sophisticated infrastructure of an industrial and information society. We must continue to place great importance on good communications, transportation and organizational links.

Canada's abundance of resources in a world of increasing scarcities offers the strong prospect of new jobs in extraction, processing and secondary manufacturing industries. For this to happen, however, we must pursue the development of our own national resources aggressively — perhaps using some of the methods I mentioned a moment ago. I believe that unions have an important role to play in suggesting, promoting and participating in developments of this sort.

As a developed nation in a world in need of technical know-how, we have tremendous contributions to make in new high-tech fields like microelectronics and biotechnology. Here, too, we must play an active part in securing our future by encouraging research, development, manufacturing and marketing with all the tools and incentives at our disposal.

Technology, far from representing an insurmountable threat, could be the agent of a resurgence for Canada. Working people will respond appropriately to the challenges of technology if they are involved in helping to define its scope, guiding its implementation and adapting personal skills to make best use of it. In that way, they, too, will share in the rewards.

TECHNOLOGICAL CHANGE: BURDEN OR BENEFIT?

Dr. E. Margaret Fulton
President, Mount Saint Vincent University

Guy Saint-Pierre has effectively focussed attention on the economic concerns related to technological change, while James McCambly has dealt with some of the changes which will affect labour and all of our concepts of work. Both eschew those somewhat simplistic notions abroad that if we just learn to apply our new technologies with greater expertise, the results will mean greater productivity; hence an improved economic outlook and all will be well! But will it?

Two really critical issues face us: the continuing production of wealth, and the distribution of wealth. These two issues are inextricably tied in with the quality of our lives and are therefore issues that require value judgements. The essential question to ask is what matters most — the project or the people?

Increased productivity has become a kind of panacea for solving all our social ills. The "P" formula of processing, packaging, promotion, and pricing certainly promises greater profits, but the "P" that is too often forgotten is *people*. We ignore people at our peril, for as Jim McCambly rightly suggests, products are of little value if people have an insufficient share of the wealth with which to purchase the products.

The most effective way found to date of sharing the wealth has been to pay a fair day's wages for a fair day's work. But as Ivan Illich has pointed out, in most societies the vast bulk of the life-enhancing work done is "shadow work" which indeed remains unpaid. Most "shadow work" is domestic work, it is the work largely done by women in the nurturing of young children and the care of our homes. Many economists are rightly turning attention to finding some way of including this kind of work as part of the Gross National Product in Western societies.

Again as our other speakers have indicated, we must find ways of radically re-structuring our whole society. Given that the two central problems are production of wealth and distribution of wealth, there is yet a third question that must be raised — on what is the greatest proportion of our wealth expended?

Before attempting to answer that question let me first suggest that in all of our societies the world over, two developments will eventually bring about a total transformation of our global society. One is the technological revolution and the second is the women's movement. It is the latter which forces us to look at the moral and ethical implications of the social changes effected by technological innovativeness.

During the late 18th and early 19th century industrial revolution, the spectacle of "the rich getting richer while the poor got poorer" sufficiently raised the consciousness of the leaders in society to pass the kind of legislation which gave people many of the rights and freedoms we so cherish today — two being the right to work and the right to vote.

It is unlikely that the social legislation that freed slaves and protected workers would have come had there not been severe unrest among the people and many of those activities which today we describe as "terrorist acts". John Stuart Mill, that great visionary of the 19th century was one of the first to recognize and label the "industrial revolution". He was also one of the first thinkers one hundred years ago to warn against subscribing to a simplistic determinism of scientific progress.

At a major Commonwealth Conference on Technology held appropriately at Birmingham, England, last August, which I was privileged to attend, a number of eminent scholars, scientists, and industrialists debated this very issue of the scientific single vision. Dr. Thomas H.B. Symons from Trent University, in a well-researched paper, pointed out that the cultural impact of industrialization and technological innovation needs now to be carefully scrutinized. The assumption that all technological change means progress for the human race lacks credibility in these latter days of the 20th century.

Taking a historical perspective then we can turn to another great socio-cultural thinker, John Ruskin, to find that the questions he posed in the mid 19th century remain unanswered today. Ruskin's first concern had to do with the preservation of nature and of ecological balance in the face of man's capacity. Ruskin shared to a lesser extent Blake's distaste for "those dark Satanic mills". One wonders what Ruskin would say today about our penchant for building hydro-electric dams in developing countries which invariably serve the needs of foreign manufacturers at the expense of the local inhabitants. These dams flood vast tracts of fertile land, forcing the poor in the Third World off their rightful territories

and depriving them of their homes and any means of livelihood. These poor tenant farmers and their families inevitably find their way into the slums of growing cities where there is already a staggering 50 percent of the labour force unemployed. From being respectable working members of a rural Third World, they are degraded into a new class of unemployed urbanized poor. The dislocation of workers in our own sophisticated society as a result of technological change is nothing compared to what happens to these indigenous peoples.

What matters, the project or the people? Dozens of examples in countries like Ghana or Haiti or the Marshall Islands can be found, but in fact we need not go outside Canada to find examples of industrial and technological developments destroying the environment. As Tom Symons points out, we have made "rather a speciality of damming rivers, blasting mountains, and building lakes, without much prior examination of consequences".

We managed in the 1970s to flood huge tracts of land without even knowing what minerals lay under the ground flooded. In tropical countries especially, reservoirs and backed up stagnant waters provide breeding grounds for debilitating and sometimes fatal diseases. We need not look very far to find the source of so many of the destructive new viruses many people suffer with. Add acid rains, poisonous chemical sprays, food additives and increasingly unacceptable levels of radiation and it can be demonstrated that we seem bent on destroying nature, not preserving it.

Can we any longer think that we cannot afford to correct pollution? Surely the time has come to realize that we can no longer afford not to clean up pollution. We do have the expertise and there have been some spectacular successes — the Thames River as a case in point.

Ruskin's second concern had to do with the increased exploitation of man by man, made possible by technological innovation. If he feared the unscrupulous use of the printed word as a means of perpetrating propaganda, what would he think of the uses the modern media have been put to? Control of the media in totalitarian states means control of the masses. And even in our own democratic state the possibilities for the misuse of much of our new computer technology exists. Machine operators can be electrically monitored and other abuses such as invasion of privacy create tension and conflict in the workplace. On the one hand there are all the advantages of mechanization, computerization, and many labour-saving devices. But, on the other, there is boredom, repetitious functions, and exploitation.

While recognizing the fantastic technological achievements in the communications and information industries, it has to be acknowledged that misuse of the media can threaten the human values of our whole culture. If the "media is the message" as Marshall McLuhan stated, then something must change because the present message of cheap consumerism, pornography and violence contributes only to a pollution of our minds.

The increased exploitation of man by man on an individual basis is probably only exceeded by the exploitation of woman by man. No technological advance was heralded as social progress more than the birth control pill; yet the results have not all been beneficial — increase in pelvic disorders among women, cancers in young women, increased venereal diseases, difficulties of bearing children, and increasing birth defects among newborns are all part of the social and health consequences of a new technology that was produced and marketed before being properly tested.

Questions surely must be raised now about genetic engineering, or incubator or test-tube babies. Does society need that sort of technology? What kind of human being will result from the child whose mother during the pre-natal years has been an infra-red light bulb?

While new technologies are found to cure the effects resulting from the use of older technologies, it seems ironic that society never puts the same emphasis on prevention of negative consequences as it does on researching cures, or finding solutions to new problems. Cancer is a case in point. Surely it makes more sense to prevent it than cure it.

But before my time runs out, let me turn to Ruskin's third concern — that of international relations, i.e. the exploitation of the less developed countries of the world by the so-called more developed nations. One need only point to the mammoth arms industry to know that while man's science can transform the world to make it more habitable and prosperous for all, misuse of the science of nuclear power can reduce the planet to a republic of "insects and grass" to use Jonathan Schell's phrase.

Without exception the main speakers in Birmingham singled out the dangers of nuclear war between the super powers as the central social and moral concern, thus raising the question not only of what changes for society do we want to effect with our technological innovation, but also on what do we want to spend the vast proportion of our wealth.

Modest estimates demonstrate that over $400 billion are spent annually on the armaments industry. Just think what the smallest percentage of that amount could do to provide water to drink and clean air to breathe for all planetary people.

If we return to our central question of creation of wealth, it has to be acknowledged that all Western countries including Russia and Japan excell at creating wealth by producing and marketing death-dealing weaponry. Are we ready to say that we want to divert funds for the arms trade to more life-giving projects? Are we ready to change our attitudes about both the creation of wealth and the distribution of wealth? Are we ready to seek for a needed new social paradigm?

Occasionally at different periods of time there arise ideas and discoveries so fundamental in their implications that the entire process of advancing knowledge, thus causing major social change, is deeply affected. It is these ideas which lead to the discovery of new social paradigms. Such an idea was the splitting of the atom.

Albert Einstein himself stated that: "When we released energy from the atom, everything changed except our way of thinking. Because of that, we drift towards unparalleled disaster." Einstein also pointed out that peace could never be procured by practicing violence. The drift toward global totalitarianism escalates daily, but new voices are being heard which challenge the madness of the nuclear arms race.

Our own Prime Minister has committed himself and Canada to new peace initiatives, and in so doing he makes it imperative for us to evolve for our nation a new economic structure which is not rooted in the old hierarchical industrial-military model. The demands for change which recognize the need to consider questions of moral and ethical significance, in addition to those pressing concerns dealing with economics and employment, take on a note of compelling urgency.

Ironically while our technological expertise has brought us to the brink of the abyss, it can also help us find our way back from the edge. We must indeed set about radically re-structuring our society. To do so we must recognize that women are the catalysts for change because they are outside the present structures. In order to re-define work, to find more flexible systems to serve all the institutions in our society, whether political, industrial, syndical, or educational, we must let go of stagnant tradition. In order to transform society, we must even re-think our cherished myths about ourselves and our concepts of order. Inevitably the results will depend on our willingness to eschew vested interests and to come to grips with informed value judgements.

No one quite knows how to go about dismantling the unwieldy bureaucratic institutions which no longer serve any branch of society effectively, be it business, labour, government, or education. With vision and good will, however, and wise use of the information available to us, we can set about creating a new society. We can harness technology to our human needs. We can make it a positive force. If we are to have a viable Canada for tomorrow, we'd better start making some constructive changes today.

PANEL NO. 1: QUESTION PERIOD

Michael Farley, Institute of History and Social Political Studies of Science, University of Montreal

I have a question which I would like to address to the panel 'en entier'. I think we heard several arguments regarding the economic benefits and the social concerns of technology and I think it was rather reassuring also to hear that different institutions, or different sides, of the political side of the argument are willing to compromise and, certainly, participate in working on solutions.

There's a third issue which wasn't addressed — well I would say a third and fourth issue — the cultural and national issue related to technological change. I think if we take the example of the transfer of technology to Canada — considered by Mr. Saint-Pierre to be important for the competitiveness of Canadian industry — we can tie in certain cultural and national issues to that transfer of technology. Telecommunications, on one hand, could reduce the development of certain linguistic groups in Canada.

I'm just wondering how business, labour, feminists, etc. are willing to allow the national and cultural issues into the debate on the implementation of technology in Canada. Are you willing to consider, for example, that if technology is economically important and can be socially worked out, but can also be culturally detrimental, that your groups are willing to incorporate those kinds of considerations in taking decisions in your different institutions.

Guy Saint-Pierre

Well I would say that they tend to be opposite megatrends. There is no doubt that technology has no boundary, therefore I don't think that we could logically take the stand, because this might be some bad element. Both in terms of a cultural and nationalistic point of view, we're going to protect ourselves. We're a trading nation; others will do it, we'll have to do it ourselves.

This being said, quite probably anyone who's read a book on current megatrends would say that, inasmuch as people become more aware of the national dimension they'll be seeking an identification with things which are much smaller in terms of scales than had been the case before. I think the same would be true, not only of Canada which has a peculiar cultural and nationalistic composition, but also numbers of other countries where people in a region will try to have a greater sense of identification with things very close to them.

René J. Bernier, La Pocatière, Kamouraska, Quebec

Mr. Chairman, I have been teaching in public colleges for 18 years. I am greatly interested in our young people's training. We all know that human thought requires a basic tool, i.e., language. The theory of language allows for communicaton between individuals, hence the necessity for a mother tongue or everyday language. It also allows for adequate advancement in a trade or profession, hence the necessity for the language of mathematics. And it allows for effective and practical handling of basic information, hence the necessity for computer language. We know, however, that society must cope with an ever-increasing number of functional illiterates, educated illiterates, i.e., people who cannot read, who do not grasp the meanings of words or the value of a word, who can neither write nor count. I would like to know if this is, in your opinion, a cause for major concern in a world where profound technological change is taking place?

Dr. Margaret Fulton

Well, it's certainly a major concern to me, because that's what I'm saying. Unless you teach people, unless they have some ability to make judgement, they are simply going to become trained robots. I would contend that we're hearing much too much today from government funding agencies about training and providing more skills, not dealing with what makes us fundamentally human, and our language does make us fundamentally human.

As a case in point, much more money goes into NSERC (Natural Sciences and Engineering Research Council) for technological and scientific research, than ever goes into SSHRC (Social Sciences and Humanities Research Council). In response to your question, there is an imbalance in the amount of funding that goes to research and study into what is essentially part of our human nature. We're not developing fully the potential of humans. We are thinking, instead, that if we get more technology, that will be the substitute for humans. I think that is a mistake in concept.

Dr. John Evans

The element of human resource development, I think, has been illustrated by our speakers this morning and this afternoon as extending beyond the area that's usually cited, namely the production aspect of technology to the whole area of understanding technology.

One of the dangers of more sophisticated technology is that it becomes a black box - very much more difficult to interpret. If we are to make enlightened judgements to avoid fear and over-reaction, in relation to technology and if, as Mr. McCambly pointed out, people who have not been trained in technology are to make a contribution to its application, then there must be a much broader understanding about the technology. We have to think of human resource development very much more broadly than just the training of the individuals who are actually going to be the productive elements in the future of technology. They are extraordinarily important, but there's another equally important dimension to human resource development.

Jake Knoppers, Infoman Inc.

I'd like to tie in with the comments by Mr. McCambly about the definition of work. We seem to have two themes running through this conference: one is the application of the new technologies in the industrial society — to do things better, cheaper, more effectively, create new products. At the same time, we're talking about an information age.

Is the concept of employment not an industrial age term? If so, the question of redefining work in an information age has to be rethought, perhaps along the lines as you mentioned of being gainfully occupied. Employment was not a term in the first wave. With respect to the information age, how do we deal with gainful employment or non-waste of human resources?

We're looking at unemployment figures. Yes, there are people unemployed, but basically what we have is a waste of human resources with people not gainfully occupied. How do we deal with work in the industrial concept with respect to application and integration of the new technology yet, at the same time, provide a framework in the information age? This, with respect to being gainfully occupied, usefully occupied and contributing to society in a non-industrial way. The industrial second wave is receding and giving us the liberty, the freedom and the resources to move into the third wave.

Mr. James McCambly

Well, I think you answered some of your own question, but there's no doubt changes are going to be needed in Canada to deal more effectively with improvements within the industrial part of our society. At the same time, there's a host of things that need to be done in terms of having an acceptance of other types of activities that could be considered to be meaningful employment.

Being a person brought up with a 'Protestant Ethic' of work, as I presume most of us all in here have been, it's a very difficult thing to even consider. But it has to be done, there are going to be avenues that have to be explored, including continuing adult education, changes right from the very beginning of our education system and changes in terms of the relationship between adults and their children. There's all kinds of things that need to be done to bring out more of the aspects of better communication — the opportunity for people to be innovative, to use intuitive skills, rather than simply be held to the old school of thought in terms of the type of training they would have received up to now.

Dr. John Evans

If one can add an editorial footnote, there has to be some 'wealth generation' in the system. A key issue is the extent to which Canada, in a changing industrial manufacturing mode, can remain competitive in 'wealth generation.' Otherwise many of these other goals are going to be extraordinarily difficult to carry.

Michael Cassidy, Member of Ontario Legislature

I think one of the key questions in any discussion of the impact of responding to technological change is the question of how, in fact, to ensure that the human factor is respected and how to ensure that there is participation and cooperation in terms of implementation and adapting to technological change.

All of the panelists have made that point, but I'd like to add a key question: How, in fact, is that to be achieved? Specifically since you would be speaking from the side of management, what kind of initiatives could you see being taken, either from within management or possibly in terms of public policies, in order to ensure that you don't get defensive reactions from workers who fear the loss of jobs or have negative feelings towards the rapid introduction of technological change?

What kind of things can be done to retain or ensure confidence on the part of working people, so that they will be prepared to have a commitment to productivity — to doing things outside of the bargaining table — and where do you see the first steps being taken in that direction?

Mr. Guy Saint-Pierre

I think the question is a very pertinent one. Currently there are a number of Royal Commissions and other groups trying to examine a thing that's still alive — that's called Canada — but obviously has a lot of weaknesses and so on and so forth. In my view, no progress is going to be achieved unless we can have some substantial improvement in labour relations. I guess all of us in government, business and unions have to rethink exactly what our approach will be.

There's been a tendency to say that the other one is responsible, that we should change the labour code. Everyday we're confronted by cases which just don't make any sense in the workplace. How can we change all of that?

Maybe my answer is a very simplistic one. Some people may say that we're going to need new legislation, or a more centralized labour group in Canada — so that one boss talks to one union man, like in some European countries. I don't think it would be a solution, given the geography of Canada. I would have thought we have to go back almost right to the basics. It will only be possible to address the social issues if there's a mutual respect — a better communication. We must try to understand the other point of view. It's a basic exercise of democracy, of being convinced of one's belief but, at the same time, admitting that we might be in error most of the time.

Dr. John Evans

I'd like to ask you, ladies and gentlemen of the panel, to consider the rapid extent to which Canada is falling behind the developing nations in our ability to apply technology, and to ask yourselves if we can afford to be as preoccupied with constraints as we've been today. Especially, when young people want to hear a message of hope.

All the panelists have spoken of improving labour relations and making a continuing commitment to research and development. But my feeling is that we're not taking a strategic enough approach to this serious problem. I would have liked to have seen the conference called "Planning for Canada's Tomorrow" and I wonder when we talk about increasing the taxation of our natural resources, recognizing that's the only thing that's saving us internationally.

A diminishing amount of income from natural resources and a growing dependence on imported products of technology is the reality that we face. Taxing the production of resources and taxing the creation of wealth serves to apply a rent to the product of technological achievement — at a time when we should be making special tax concessions and incentives to expand and increase that.

Are we presenting a message of hope to young Canadians today or, by being so preoccupied with the constraints rather than the opportunity, are we really defeating the purpose for which this conference was called?

Mr. James McCambly

I don't think anyone should be given a pessimistic attitude in Canada, as we don't have a very bright situation at the moment. But if there's any country that can look to a good future, then I'm sure that we can. If there is anybody in Canada that doesn't believe it, then I'd like them to show me a country that has better opportunities than we do.

But in talking about the economic rent, for example in the export of natural gas, there's very little value added as far as the human element, but our balance of payments look good — it makes us look good on paper. The Japanese, for example, are not going to get any money into their country from natural gas exports, so they're starting from a base that is different from ours.

I think we have to be realistic and know where we're starting from. We're fooling ourselves by having money coming in from natural gas exports without utilizing it in the best possible way. Maybe we should explore that since we've got a lot of advantages going that way.

You also asked about the specifics of what might be the kind of avenue to give us better approaches. Well, I have a meeting tomorrow morning on the productivity and economic growth centre for Canada. Some $5 million has been allotted to the centre, which will be under the auspices of business and labour with government cooperation and participation. That's a small start — I think it's a place to get going, to say "allright, let's see what we've got to do and let's help people help

themselves to use technology and make use of the kinds of things that are necessary to have us produce."

I hope that my remarks didn't suggest that organized labour, at least from the perspective of the Canadian Federation of Labour, would stand in the way of Canada's progress. I think that we have to pull out a lot of stops and go toward progress, towards developing and generating wealth. If we don't have wealth, what have we got? We don't have anything to share, so there's no sense talking about sharing something you don't have already.

Peter Leigh-Bell, Peter Leigh-Bell Associates

In the course of talking about new technology in "Canada Tomorrow" we've had to get used to a whole new vocabulary almost every day. When it comes to human relations in the union movement, we're dealing with a vocabulary that's been known to me all my life. We're still talking about the working class. Working class is a term that was coined at the time when you had the idle rich and the servants. We no longer have that.

I think one of the prerequisites, one of the necessary ingredients to making this conference succeed, is to arrive at some sort of conclusion as to what changes should take place within the trade union movement. We still have craft unions, whereas in Europe unions are organized along industrial lines. This allows them to do a variety of things in the interest of a particular industry, in the interest of job preservation, in the interest of safety. We don't seem to be able to do that in this country. I should like to have a response from the panel on the subject of new technology and the union movement.

Mr. James McCambly

Well, I would sure challenge you with regards to the efficiency of the European system compared to the North American system. In terms of the quality of the work, the speed of the work and the safety under which it's done, I feel that our unions in the craft system are as innovative as any.

Our unions are not standing back idly, unprepared to do things. They have schools, and people come in at night for upgrading and expanding their skills. They're not in some tunnel vision where they're not prepared to look at other alternatives. In fact, they're quite prepared to do things that are innovative. You show me the challenge and then we'll see whether we can deal with it.

Peter Lang, Member of Parliament for Kitchener

One of the areas that I would like to express a concern about is that all the speakers have said that dramatic changes will be taking place in all areas of society, in a very short period of time. This is half of the formula for a massive increase in stress that all people will feel.

At present we see that there are many maladapted ways in which people are responding to stress — alcohol abuse, drug abuse, etc. I'm wondering if this is an area in which we should also be using very innovative thinking, and possibly new kinds of institutions or cooperative efforts to deal with the massive problem that will be coming upon us.

Dr. Margaret Fulton

These are some of the human problems we have to face. We're not going to face them if we put all our eggs, as it were, in the research technology basket. We have not done enough in terms of looking at social problems and providing the kinds of research monies to actually study ways of solving these problems from a preventive method, rather than always looking for the cure after the fact.

Dr. John Evans

As I listened to the panel discussion, it did appear that there was a very broad consensus that Canada would have to apply more intensively the new technologies. We talked just about a few of them. We didn't talk about materials research, or a whole series of areas that might be included. We'll have to apply the new technologies, in order to participate in the 'wealth generation' broadly in the period ahead.

In addition to the generation of wealth, one has to say that wealth is not enough. The quality of life in the country has to be improved, if possible, during that same period. This morning's speakers, and particularly the panel this afternoon, have addressed themselves to some of those issues that are critical in the duality of life — not as impediments to technological progress, but as considerations as to how technological progress can be made more humane.

One of the things that comes out most strikingly is that adversarial systems — whether it's in the macro area, between levels of government, among government, labour and business and at the micro level within the industry — no longer seems to serve our needs very

well. If we are to remain competitive, we must look at the models elsewhere. Models that seek a much more collaborative approach, harnessing the best of the human resources in each of these sectors, rather than disqualifying or discarding that resource.

If we look at our base in technology, we are late starters for the most part. We have a few areas of strength, but we don't have the kind of strength and breadth that is seen in many other countries, almost across the board.

If we are going to remain competitive in generating wealth, we will need to have the cooperation of our universities, our government laboratories and our industries. A cooperation that does not presently exist in Canada, but is emerging in other countries. Only in that way can rather sparce resources be concentrated to produce the kind of impact that will keep us competitive.

The underlying theme heard this morning of going it alone, a confrontational route, is not one that is likely to serve Canada's interest all that well. The challenge is to develop the kinds of mechanisms that will act as a stimulus for harnessing the potential of all of the partners in order to achieve success.

PANEL NO. 2: INTRODUCTORY REMARKS

Mrs. Lucie Pépin
President, Canadian Advisory Council on the Status of Women

Good day and welcome, everyone.

Allow me to introduce myself: I am Lucie Pépin, President of the Canadian Advisory Council on the Status of Women. Today, I will be chairing discussions of the last two themes of the conference, which are "Putting the Technology in Place" and "Adjusting to Change".

I would like to introduce to you the panelists for this session: Dr. Wendy Dobson, Executive Director of the C.D. Howe Institute; Dr. Norman Wagner, President of the University of Calgary; Mr. Larry Clarke, Chairperson of Spar Aerospace; and last but not least, a man with a very lovely family name, Mr. Marcel Pépin, Associate Professor at the University of Montréal.

As chairperson of this panel, I have taken the liberty of adding a subtitle to our session which is "A Nuts and Bolts Perspective". While I realize that this somewhat mechanical phrase may be rendered meaningless by the new technology, it nevertheless appropriately describes the approach which this panel will take to the issues at hand.

As the conference has already well illustrated, technology has two faces. On the one hand, there is the tremendous potential for economic development and prosperity; on the other hand, the alarming possibility of social dislocation and upheaval. Really, all of us are in much the same position as the parent who, wanting to do a good thing, hands her or his child a cookie and the child says, "Now, let me get this straight. You are rewarding me with cavities, unstable blood sugar and an increasing waistline!" The challenge for us, of course, is to find out how to digest the cookie without suffering the negative consequences.

We will begin today with Dr. Dobson who will look at technical innovation from an economist's perspective, pointing out possible policy options. Mr. Clarke will then provide a corporate sector perspective on innovation drawing upon his personal and practical experience in founding Spar Aerospace. We will then turn to Dr. Wagner and Professor Pépin both of whom will discuss the so-called "safety nets" required to ensure successful adaptation to technological change. Mr. Pépin will touch on possible impacts of technology and on means to ensure that all groups in Canadian society reap maximum benefits from technology. Dr. Wagner will specifically look at the paradoxes of creation and destruction of jobs and the role of education within this.

Before we begin, I would like to add one particular element to our discussion and that is to consider the position of women. Women most assuredly will be the single largest group affected by technological change, both in the short-term and the long-term. In the short-term, it is primarily women's jobs which will be eliminated by technology. In the long-term, it is questionable whether women will share in the jobs created by technology, as women have not been equipped with the necessary scientific and technical skills to capitalize on emerging employment opportunities.

These are concerns which I have brought to the attention of our panelists and I look forward to hearing their responses to these issues.

ADJUSTMENT TO TECHNICAL CHANGE

Dr. Wendy Dobson
Executive Director, C.D. Howe Institute

Canada is recovering from one of the most severe recessions in the industrialized world. Unemployment nearly doubled between the beginning of the recession in 1981 and late 1982, rising from 7 to nearly 13 percent. This abrupt and dramatic increase will probably disappear with full recovery. But anxious questions are being posed about jobs lost through technological change, as employers in both the public and private sectors seek to reduce costs by trimming work forces. This has resulted in confusion about the benefits and burdens of technical change and the magnitude of the adjustment required. And an intelligent, effective adjustment response depends on an accurate understanding of the sources and magnitude of the problem.

My purpose, therefore, is to examine the options for adjusting to change in the light of what we know about the issues and the problem. I will argue that technical change has always gone on, and that concerns about acceleration of this change — until we are clear about the magnitude of the possible disruptions — should prod us to reorganize to make adaptation a way of life. We do not have to live as if the dice are loaded against us.

The basic goals of economic activity are to raise living standards and create employment. The success of technological change has always been judged by the contribution it makes to these goals. In a world in which other sources of economic growth — cheap resources and other productive inputs and favourable terms of trade — are becoming increasingly uncertain, the role of innovation has increased in importance. New ways to produce more efficiently have proliferated. Almost no workplace can avoid cost cutting and productivity-augmenting change and hope to remain in operation.

These changes are always made more easily when rapid economic growth acts as a lubricant. But today they are being made in a slow growth environment for a number of reasons. The world has experienced the ending of a period of rapid inflation during which uncertainty about future costs made new investment risky; rising prices distorted the productivity record and hampered the efficiency with which enterprises were managed. The dramatic drop in demand and inflation during the recession changed all that. Cost cutting that affected wages and employment became essential for survival of many firms. The same entrenchment has been true for nations, faced with servicing expensive debts incurred in the heady days of the 1970s. This has made for a fiercely competitive trading environment in which productivity growth is a vital determinant of success.

In this general environment, innovation — which includes organizational efficiency as well as the introduction of new machines — is in great demand. In a recession such as we have experienced it is not technical change that leads to unemployment, but the reduction in demand for what was produced. Innovation increases potential output, given existing inputs. Costs are reduced, productivity and profits increased. Industries with better than average profits attract new producers, and create more jobs. There is also the potential for reduced costs and reduced prices of goods and services.

The introduction of new technology can lead to sustained booms, either because capital needs to be replaced, or because new consumer goods are developed for which there is excess demand. Indeed some firms which adapted quickly or are producing new technologies enjoying surging demand have been "recession-proof" in the recent downturn.

This is the general pattern that was established in agriculture fifty years ago. When the then-small farms were mechanized, productivity rose and farmers experienced a rising standard of living. A massive shift in employment also occurred, into the urban areas and the secondary manufacturing sector. This shift was accomplished relatively smoothly. Yet if this conference had been held in 1910, it probably would have agonized over where the jobs would come from.

Has anything changed since then? The issue that has emerged is whether the pace of technical change is accelerating at a speed that changes both the nature and amount of work that is available. The main proponent of the accelerating change scenario is the labour movement. The central concerns focus on control of innovation and jobs. Privately-controlled innovation can endanger the interests of workers, it is argued. They are at risk of unannounced plant closures, layoffs, and involuntary changes in the workplace. Displacement of workers by labour-saving technology is considered to be

inevitable and of a magnitude that threatens the social fabric.

Several important factors will influence the actual outcome, and therefore, the adjustment policies that may be required. The first factor is the economic environment. Because of the severity of the recession, Canada is experiencing a high level of cyclical unemployment. A resolution of the policy conflict in the United States that holds up real interest rates and prolongs the recession would soon restore growth momentum and many of the jobs lost in the recession in Canada. So adjustment policy must be guided by the magnitude of unemployment that is cyclical and therefore temporary.

The second factor has to do with flexibility in prices and wages. Technical progress can proceed at a pace that is faster than the existing ability of the labour force to retrain or move to new jobs. Skilled and semi-skilled workers seem to be particularly vulnerable, but it is important to distinguish whether greater flexibility in relative wages would prevent their becoming unemployed. While their jobs may be replaced by labour-saving technology — this seems to be happening in parts of the North American auto industry, for example — they will be able to find other jobs requiring their skills, although some of these jobs will be paid relatively less. The important point here is that wage and price flexibility can be an important mechanism of adjustment.

The third factor is related. One of the concerns underlying the unemployment hypothesis has to do with the increasingly competitive developing nations who have penetrated labour-intensive goods markets in Canada, such as those for textiles and footwear. The initial response has been to protect jobs by imposing import quotas. But this action simply postpones the day of reckoning. More realistic is to recognize the inevitable competition and set a time limit for lifting those protective measures. During that time, painful adjustments will have to be made to improve the industry's competitiveness, or to close down and assist workers to become re-employed elsewhere.

The fourth factor is how Canadians make these choices — between temporary disruption and loss of security in the short run, and a higher standard of living in the future. In choosing the latter, there are painful adjustments to be made but they do not throw everyone out of work. The key to adjustment is to avoid shielding against inevitable and permanent change, while cushioning the negative impact of these changes on individuals. Policies can be designed to facilitate adjustment, through creative use of public funds to enable workers to retrain themselves, to temporarily share jobs, to move to locations of expanding employment, or to subsidize employers who provide workers with new work experiences. An improved industrial relations climate and commitment by employers and workers to facilitate adjustment can greatly dispel fears about uncontrolled introduction of change.

If Canadians choose to avoid adjustment to technical change because they think it will save jobs, they risk consigning themselves to a lower standard of living and to fewer jobs in the future. Failing to adjust also avoids another benefit of innovation that cannot be planned — the breaking up of monopolies and vested interests. It is often those interests, be they labour, management, politicians, bureaucrats or economies, that when threatened seek to block change and plead for more public control. Thus adjustment policies should be framed after weighing the national interest against the interests of particular groups.

We have little choice but to adopt new innovations. Nearly everyone accepts that fact. The challenge is to reorganize our policies and institutions to facilitate adaptation. This means the role of public policy is to facilitate, not obstruct, change. Thus governments should accept the direction of change, facilitate the investments in people who must re-educate or relocate, and reformulate social and economic policy so that they facilitate adjustment. Lack of portability in the pension system is a good example of a policy that has blocked adjustment. The tendency for particular groups to obtain protection and block change is another factor that can frustrate redirection of policy. The role of the private sector is to experiment, and take risks in response to profitable opportunities. It is also to practice good management by introducing change cooperatively. There, although there are notable exceptions, the general prospects are not promising because of the atmosphere of mistrust and confrontation that has characterized industrial relations in Canada.

Canada's adjustment policies must emphasize flexibility — in developing human resources, providing safety nets, in labour-management relations and in commercial policies. Applying these policies to smooth adaptation to change strengthens rather than weakens the social fabric. It also raises productivity. But the real challenge is to increase the productivity of our ideas for addressing these problems.

TECHNOLOGY: SERVANT OR MASTER?

Mr. Larry Clarke
Chairman and Chief Executive Officer, Spar Aerospace

Ladies and Gentlemen...I think we were very fortunate this morning with our three keynote speakers. They graphically described the situation that they have faced and will be facing in their three countries and I think there is much for us to learn from a study of the remarks which they have made.

For my part, I will try to deal with the subject of "Putting the Technology in Place" and "Adjusting to Change" with a few graphic examples of technologically-inspired change and their impact, followed by a short case history of a specific Canadian activity in advanced technology, and concluding with some thoughts on how we, in Canada, should approach the problem of adapting to technologically-inspired change. However, before quoting these specific examples, I'd like to go on record as having the theme that we, as a nation, should not be afraid of technology. Let us make it our servant, rather than our master.

I have two dramatic illustrations — they're probably rather trite for most of you — but I think they graphically put into context the impact and force of change. The first is that if automobiles had developed, as has the microelectronics field over the last two decades, we would be getting 12,000 miles per gallon on our Buicks and Pontiacs and the cars would cost five dollars. Another equally-forceful comment is that we could fly today from Ottawa to Vancouver for two dollars and fifty cents and throw the airplane away on arrival.

Certainly, from these examples, you can see that we are in the midst of a dazzling, dizzying revolution of workplace change. Sixty percent of our workplace is now made up of information processors. Display terminals, teleconferencing and video-conferencing are all impacting our style and form of communication in the workplace.

What will be the results of these changes? Certainly long-term planning will become increasingly critical and more and more decisions will be made from the bottom up, rather than from the top down, in order to take full advantage of the new technologies which start from the bottom up in their impact on industry. Further, decentralization of industry will become the norm. Units will become smaller and employees increasingly mobile. There will be a corresponding growth in individualism. Corporations will move from representative to participative democracy within the workplace.

Unfortunately, there are few visible and useable statistical indicators of how fast, and in what exact form, the changes are taking place. However, one clear indicator that has been quoted many times is that in 1890, forty-five percent of the workforce was in agriculture and five percent in the information area - and today these statistics have virtually reversed themselves.

As another indicator, recently one of the major U.S. industrial giants reported that today it has forty percent of its workforce in manufacturing and by the year 2000 that number will shrink to five percent, as hardware turns to software and the labour force is converted from blue-collar to white-collar roles. This change is exemplified by the experience of the Bell Telephone System which in 1910 handled seven million calls with 121,000 employees. Last year it handled more than 210 billion calls, with 874,000 employees. If the same technology existed today, as in 1910, it would have taken an army of four billion workers to have handled all those calls.

For over 150 years technology has impacted on the job market and it will continue increasingly and evermore rapidly to do so. However, the soothsayers of doom have only to consider the statistics of farm employment and of the telephone industry which I've just quoted, to realize that there has been a massive new employment, arising both directly and indirectly from technological changes. And in this respect, the results of Japan which we just heard this morning, are of great interest. Without the new jobs we would not enjoy today a much higher percentage of the total potential workforce employed than we had 100 years ago, when technology was far less advanced and when the majority of women worked only in the home.

Incidently, I think we all tend to overlook the impact on labour force statistics of this massive transfer of women from domestic services to the external market. It is largely technological advances which have provided work for women and which have made it possible for them to take external and interesting jobs and to be released from the drudgery of domestic work. These

advances, in turn, have greatly assisted in raising the income, and thus the living standards, of the average Canadian household.

Technology and change — one the parent of the other. Jobs are eliminated, such as switchboard operators, but others are created as technology expands market opportunities. The hallmark is new jobs, retraining and change. To halt the flow of technology is to ensure that the nation will slip into the backwaters of global economic tides.

Now I will turn to the question of putting the technology in place within Canada, if you will excuse my using a specific industry with which I have some connection, because I believe it provides certain lessons in respect to this question.

It is my firm conviction that any developed, industrial society must comprise a mosaic of technological activities from the simple to the most sophisticated. Space-borne activities, which are critical to a country such as Canada with its large land mass and widely-scattered population, can satisfy a significant portion of the more sophisticated technological part of the mosaic, particularly when the work is performed in carefully selected activities with export as well as domestic potential.

The Space Age dawned on the world only 25 years ago, with the first Sputnik. From the very beginning Canada has played a significant and evergrowing role in the Space Age, to the point that over the past ten years it has been successful in securing almost ten percent of the world market for commercial communications satellites. In addition, the outstanding ability of Canadian space technology has been demonstrated, for the whole world to see, in the success of the Canadarm on the shuttle missions of the past two years.

The technology giving rise to these successes has been a mixture of home-grown developments and licenced and joint-venture developments. This balance has enabled Canada to stay at the market forefront in competition with leading international technology companies from the United States, Europe and Japan. And, I submit, it demonstrates a realistic and pragmatic example of an economic and practical means of putting technology in place within Canada.

So, in conclusion, how do we manage technologically-created change to the benefit of our nation today and for the future?

I believe that the most pressing imperative is to achieve a common perception, within government, industry, labour and the academic environment, of the challenges which we face and the goals which we must achieve. There must be a far more coherent perception of technology as a force and a far greater reality in dealing with it. Conferences, such as this, are a very positive evidence of the government's increasing realization of this challenge.

If I may suggest, governments must realize that technology is not something that can be turned on and off like a tap, in response to the political exigencies of the moment. While producing rapid change, its flow is based on very long-term, consistent applications of effort. What better example of this fact is there than the remarkable achievements of our federal Department of Agriculture over the last 75 years in assisting to increase the productivity of our farms, to produce the statistics which I reported on earlier.

Industry, for its part, must accept technological change as a fact of life. In all its planning, with respect to both markets and employees, it must be prepared to forecast and provide for the impact of technological change. Labour, likewise, must accept the reality of technological change and work with industry to educate its members to ensure that all who can are trained and equipped to handle such change and those who can't are treated in a humane and socially-dignified manner.

The academic community must review its roles and priorities in light of the technological age which is upon us. The academic environment must ensure that, while continuing to provide the specialized knowledge required by a technologically-based society, its courses also give students the humanitarian understanding to develop the flexibility to adjust to continuing change. Only through such duality of education and training will our future leaders possess the skills and understanding necessary to ensure that Canada continues as a developed nation into the twenty-first century.

SOCIAL CONSEQUENCES OF TECHNOLOGICAL CHANGE

Mr. Marcel Pépin
Associate Professor, University of Montreal

Having heard Madame Pépin's presentation, I should warn you that what I intend to say is rather different from what we have heard so far today, perhaps because I am not a senator — at least not yet. It is clear that my union background makes me see the situation differently.

In my opinion, ladies and gentlemen, the new industrial revolution is under way: the robots are at work, office automation is taking place, and the arrival of microprocessors heralds considerable changes in certain kinds of operations. We don't need to wonder whether technological changes will take place soon. They are taking place right now and will continue to advance. There is no point in trying to prevent or resist them. The changes will come about in any case, and those who might launch into a campaign of resistance will, in my opinion, fail. At the very most, they may delay their introduction in certain areas.

In my opinion, technological changes are not the problem. In that regard, we are only repeating the experience of past industrial revolutions, when factories were the scene of major technological innovations. It is much more appropriate to ask what these changes are, what they will be in the future, how and under what conditions they will be introduced, and what the consequences of their introduction will be. I have no objection to them, as I am sure you don't. On the contrary, I am pleased when technological changes mean the disappearance of jobs that are difficult and sometimes degrading for human beings. I think we all applaud the advent of such changes. We must be careful, however. Are we really sure that all the technical and technological changes announced are truly synonymous with progress? I would like to think so, but is it as certain as all that?

It seems to me that in the past we have lived through some unpleasant experiences. Every novelty that was introduced was regarded as progress. The result was that in the name of economic progress, we built factories that polluted the air. In certain cases, the lives and health of workers were endangered. We did all that in the name of progress, and tried to correct our mistakes later. That's why I think that we must try to understand right now the consequences of these changes, and make sure that their effects are not disastrous, but mainly beneficial. We must predict, monitor and plan change. You are aware of this; it has been pointed out many times today.

What will unions do throughout this entire operation? Will they again be perceived as troublemakers? It happens, in fact, that they are the only group that is somewhat resistant to these changes, because they foresee consequences for workers — for their working conditions, their jobs, their health and so on. And will unions play an active role? Will they receive information before the fact? Or will they again be presented with decisions that have already been made? If this is the approach taken, unions will offer some opposition, and will be censured for it. I am categorically opposed to this type of behaviour on the part of employers. I am generalizing, but I think I am somewhat justified in doing so. This scenario has been all too common.

Since employers often act in this fashion in the name of management prerogative, there should be no surprise at the attitude of the unions, which are generally excluded from the process. The habit of not consulting unions before introducing technological change has become so widespread that there seems to be no other solution but to pass legislation, even if many do not agree. This will force employers to first provide their unions with all the pertinent information, and second, negotiate the introduction of change with the wage-earners and their bargaining units. There is nothing new in this legislative process. Such mechanisms already exist and are applied in other countries.

In my opinion, the introduction of technological change will have considerable repercussions on employment. Some feel that we are experiencing and will continue to experience a shift in jobs. Others believe that the number of jobs will decrease, although the size of the reduction cannot be easily determined. I think the predictions made by the latter group are more realistic. Since the introduction of word processors into offices, employers have hastened to point out that no staff has been laid off. However, vacant positions are not being filled, and surplus staff is being transferred. Thus, while

the existing workers are protected, the total number decreases. The changes that are taking place and those to come will greatly affect the tertiary sector. It seems to me that office jobs will be the most seriously affected by technological change. And let us not forget that office jobs are held mainly by women. They are the ones who will be affected. What will happen to them? Will they agree to simply return to the home? I don't believe that women will let this happen, and they will be right in protesting. It is time to get to work and find a solution to this problem before it is too late. In order to protect women's jobs and study the entire question of decreasing employment, we must prepare to plan and monitor change, to be its master rather than its slave.

In this case, the state must intervene — and I mean the federal government in cooperation with all the provinces. I am fully aware that suggesting government intervention goes against the prevailing current opinion that government should intervene as little as possible in economic affairs. But do we really have a choice? Is it not obvious enough to us that leaving market forces alone means encouraging inequality and making those who are already poor even poorer? It would be more appropriate to ask ourselves how the state should intervene to be absolutely certain that the issue of employment in general, and the employment of women in particular, will be considered. This is not the time to decide what government agency would best fill this role, or what power should be conferred on it.

Greater emphasis must be placed on the objective than on the means of achieving it. We must act quickly if we want to be realistic.

Similarly, I hope that the impact of change on working conditions will be examined. What types of employment will be available? Will they be monotonous, mind-numbing and deskilling? Can we ensure that the situation will be otherwise, and how? Is it correct to say that in the not too distant future, we will witness the expansion of what I will call "work at a distance," or work in the home? Many working men and probably even more working women will do their jobs at home. Women will probably raise their children at the same time. Can we be sure that this kind of work will truly mean progress? Isolation from the workplace and lack of contact among workers will cause other problems related to personal development, negotiations on conditions of employment, and perhaps even stress and health.

It might also be appropriate to remind designers of new equipment that human beings will have to work with the machines they build. We could thus avoid having to adapt people to machines. What consequences can we predict for health and job security after the introduction of new technology? We must address these issues right away. Mental exhaustion is already taking its toll among workers. What effect will the new technology have on our mental health? Will we have more visual and hearing problems? The most important thing is to avoid damaging the human body. Society is paying too high a price — death, disability and ruined health — for having allowed intolerable situations to develop in certain sectors for us to walk blindly into the future once again. We need only think of people suffering from asbestosis and silicosis, among others. I realize that we cannot predict all the consequences of certain types of new technology, but advance studies would prevent the most serious repercussions.

We should also ask ourselves the same question about the quality of life in general and the environment. Should we move to drastically reduce the number of working hours, lower the retirement age, and reorganize public and supplementary pension plans? It is imperative that we resolve these problems, starting right now. We must think carefully and carry out research so that we don't lose control of the situation.

One solution might be to direct research toward the creation of jobs that would provide services useful, even necessary, to the population. For example, we have observed a real decrease in customer service in stores, especially in the larger ones; there are fewer and fewer sales people. Banking services, no matter what people say, do not seem to be at all adequate. Customers in many, if not most, branches wait many minutes before being served. Large food stores no longer make home deliveries. The elderly, the disabled and people who work and are very busy would benefit from such a service. Social services are also suffering. In hospitals, where staff has been reduced — with serious consequences for patient care — the situation is becoming increasingly intolerable. I do not believe in creating useless jobs. There are needs to be met, so why not attend to them? The resources freed in other sectors through the introduction of technological change could be devoted to improving services to the community. Some may say that applying such a suggestion could result in considerable expense. True, but are there not needs to be met? That is what we must discuss. And why should the quality of life be reduced when all the new technology is intended to make life easier and more pleasant?

The thrust of what I am saying, and I hope it is quite clear, is not that I wish to prevent the introduction of new technology — I wouldn't have the means to do

that in any event — but that we should foresee the consequences of its use and carefully plan its introduction, which should be gradual. In order for this to take place, both levels of government must become involved. It seems to me that it would be irresponsible to act otherwise. If we wait until all the changes have been made, it will be too late; by then, we will merely be able to survey the damage.

Let's try to look at what is going on. We are well aware that no society is completely independent. Canada, as we can observe, is more dependent than some other countries. Approximately 60 percent of our manufacturing is under foreign control. Will the new technology make Canada even more dependent? That is an important question that deserves careful examination. If we can foresee greater dependence for Canada, we must develop strategies to counteract this trend.

I realize that I do not offer any solutions to the problems I raise. I don't believe that it is possible to do so with our present knowledge. What I hope is that we will give some thought to the social consequences of technological changes. It is in fact probable that all sectors of society are concerned about this problem; this conference attests to that. Merely being concerned is not enough, however. We must actively seek the best solutions, and I do not believe that further education alone will solve the entire problem.

I will conclude by making two points: new technology is being and will continue to be developed. It will have an impact on all of society, and that impact may be disastrous if we do not take steps to reduce the social costs.

TECHNOLOGY, EDUCATION AND CANADA TOMORROW

Dr. Norman Wagner
President, University of Calgary

It is always difficult to face an audience with a fresh perspective when a number of distinguished speakers have had a chance to say it all. Today is no exception for me.

I beg your indulgence, however, and ask that you permit me to cover some familiar ground if I am to build my case. My approach is somewhat unique in that I will discuss the subject of technology and change in terms of paradoxes, or at least extremities, in an attempt to shed more light on our subject.

The first set of extremes is *destruction* and *creation*. This seeming paradox is an appropriate point of departure because we have come to view advances in technology as the root cause of many of our problems, be they political, economic, social or educational. Yet, technology is seen as the driving force underpinning our hopes for recovery in these same areas.

My colleague, the well-known economist Steve Peitchinis, discusses this question in detail in a new book, taking as one point of departure the work of the renowned political economist Joseph Schumpeter, who characterized technological change as the process of *creative destruction*: it destroys work skills and creates work skills; it creates knowledge and renders knowledge redundant; destroys employment and creates employment; contributes to pollution and provides instruments, chemicals and other means for the reduction of pollution; destroys established lifestyles and forms of social and economic organization and creates new lifestyles and new forms of organization.

Current discussions on the implications of technology tend for the most part to emphasize the destructive part of Schumpeter's characterization. Unfortunately, the reason for this is simple to explain. The public perception of new technologies conditions the environment within which they have to operate and determines their rate of diffusion, and hence their contribution to economic growth and well being. The problem is that some sectors of public opinion see new technologies as, at worst, threatening to their livelihood, their way of life and views of the world and, at best, as something inevitable which has to be coped with.

The creative aspects of any technology down through history have been seen later in time and they have always been dramatic. An often-used illustration is the demise of the buggy whip industry when the automobile came along. Of course this business ended, but tire stores, muffler shops, service stations, road-side cafes, tourism — the list is endless — developed instead. Similarly, today's video game industry, an industry outselling movies, is less than 10 years old.

New creations are not always trouble free. For example, air travel has revolutionized business, vacations, transportation, etc., but with this marvel has come a new level of terrorism, drug traffic and so on. Similarly, the computer industry has brought with it crimes such as information theft, perceived health problems and video arcade addicts.

It is, of course, the rate of change which causes such consternation. For example, a large proportion of Canadians left the farm over the past few decades and were absorbed elsewhere, and during that time agricultural productivity increased in a dramatic way. Do we have 50 years for industrial workers to be absorbed? That is the real point.

My second dichotomy deals with *international* vs. *national* issues. The world has always witnessed great international rivalries, from control of overland trade routes to supremacy of the oceans, and ownership of outer space. Today we face a rivalry which is truly the main event of the 80's. This is the U.S. and Japan locked in battle. Japan and the U.S. already account for nearly one-half of all production outside of the communist bloc. Their struggle to establish control of information technologies is often described in quasi-military terms. The Director of the Massachusetts Institute of Technology (MIT) computer lab capsulizes current thinking as follows: "this assault is far more serious to our future than the automobiles sold from Japan, because the computer is at the root of every future change ...the Japanese recognize that whoever controls the information revolution has, in effect, some form of increased geo-political control".

To continue the metaphor, the two nations are marshalling their forces for a global assault. Japan has announced it will conquer the "knowledge" industry by

the year 1990, pinning its hopes on winning on fifth generation computers. The U.S. is moving to apply its edge in microcomputers, regain its lead in industrial robots, maintain its lead in communications and other technologies, thus ushering in a new golden era of manufacturing.

Yet we need to remind ourselves that we are engaged in a totally new kind of battle. Information is the commodity at stake. It does not become obsolete. It keeps expanding in value; it is not consumed or used up. It cannot, therefore, be destroyed nor even contained. Access to it can only be managed and therein lies the key. Knowledge is the capital of the post-industrial society with more leverage than oil or gold.

It is therefore inevitable that control will be centralized and guarded. This raises new questions for scientists in all disciplines. One of the fundamental rules of science is the open sharing of discoveries with other researchers, both to gain acceptance and to provide an opportunity for verification and improvement. This grand tradition is bound to be challenged by the jargon embraced in terms such as "trans-border data flow", with the inevitable result that knowledge may soon be classified as the most significant element in a national security problem. Some depressing realities flow from this assumption.

Given the strength of the U.S. and Japan, the gap between the "have" and "have nots", the information rich and the information poor, threatens to grow. The Third World (and we are in danger of falling into this group) is increasingly left behind as the wealth and power of western society grows. For example, of the existing data bases 85 percent are in the north, 70 percent are in the U.S., and 80 percent of information in data bases worldwide is U.S. originated.

Public policy in Canada cannot avoid this issue. The implications for self-sufficiency and what that entails may be of greater significance than energy self-sufficiency or increased Canadian content on our television sets.

My third paradox requires two sets of terms. These are: *continuity* vs *change* or, stated another way, *productivity* and *innovation*. Everyone stresses the change and innovation brought about by technology, but we must also stress the stabilizing role, the continuity in our society. Stabilization is something we desperately need in our society as we seek to shore up our support systems, institutions, and our basic beliefs in ourselves.

If only time permitted, I would address the issue of not only women in the work force but the fundamental shift in society's assumptions as the two-parent working family becomes the rule not the exception.

The changes in employment patterns will be startling. The new "steel collar" worker, the robot, a term I first heard from Eric Seaborg, will replace many blue collar, and also a fair share of white collar, workers. However, jobs likely will not be lacking in our world. Some futurists claim that the 1980s will see over 20 million new jobs created with some 17 million new workers expected to join the labour force. No doubt, many jobs, at least from our vantage point today, will be less glamorous than the term high tech conjures up. For example: the total number of jobs for computer programmers in the 1980s is expected to be about 150,000 in the U.S., while some 1.3 million jobs are projected for janitors, nurses aides, and orderlies; 75 percent of all factory jobs may be replaced by robots, middle managers will be eliminated; and computers will eliminate 300,000 "drafters" in the U.S. No high tech job category makes the U.S. Labor Department's top 20 in terms of total number of jobs added to the economy.

We should not leave the subject of productivity without at least referring to the point Bob Russel made a few weeks ago on *The Journal*, when he reminded us that our competitive edge becomes possible again when our robots work as cheaply as the robots of our competitors. That is, with our abundant resources, the current edge available to countries able to find cheap labour disappears. Unfortunately, the opportunities for mere survival in some less developed countries will be lessened. Innovation immediately leads us to the centrality of education, not only the expectation that our researchers will produce the highly significant breakthrough, but to teach us how to adjust with dignity to a different lifestyle. More on this in a moment.

My final paradox has to do with *complexity* and *simplicity*. Today's achievements in complex design and manufacturing are almost beyond belief: millions of tiny wires and "things" on a wafer the size of your finger nail! Yet, one camera maker tells us the product is so advanced it's simple. That ad conveys a startling message.

Factories now run with only a guard at the door; robots make new robots; computers diagnose their problems and produce their own software. If the fifth-generation expert systems become what many of us feel they will, the role of the operator will be simple indeed.

Today's scramble to have colleges and universities train highly skilled professionals seems to me to be both a short-term necessity and a long-term disaster. While the one in a thousand who makes a breakthrough has to be nurtured and encouraged to make the discovery, the 999 may well be the unemployables of the next decade. The more highly specialized the task, the easier it is to have a computer do the job. I admit, the problem is extremely complex, but I must say I miss a thorough discussion of this subject to date. The recent report to the Minister of Employment and Immigration entitled, *Learning a Living in Canada*, misses this point entirely. This is unfortunate, since the report itself is a very thorough and generally imaginative effort. The solutions are dramatic and far-reaching. The premise, however, I believe is faulty except for the short-term, and must be addressed.

Time prohibits a fuller discussion of other similar points, so I turn to some concluding remarks on education and its role in "Canada Tomorrow".

No nation can expect to stay in this new "game" unless a major part of its industrial strategy is focussed on improving its "brain power", and brain power is a human resource! A nation's ability to harness the pool of knowledge, either developed by it or available to it, will be the key determinant to participation in the information age. Industries of the future will depend more and more on "software", that is, the thinking or creative side of problem solving.

A recent report in the *Wall Street Journal* should cause us to pause. A New York Stock Exchange report on Japan found that even more important than quality circles, technological advantage, etc. was the high degree of educational accomplishment in primary and secondary schools. Japan already spends 10 percent of its Gross National Product (GNP) on education, the U.S. only 6.8 percent. *Nation at Risk* could not have come at a better time for U.S. leaders to make a case. Canada, on the other hand, is looking at a process of retrenchment. This, at a time when we are advised that 1,000,000 adults cannot read; that 35 percent of our labour force has less than a grade 8 education.

My standing challenge to politicians, business people and fellow educators is to debate, in detail with the gloves off, the question of whether education is to be treated as an expense or an investment. Only then can we intelligently move ahead.

Historian Arnold Toynbee remarked that progress in technology was in fact a challenge to progress in virtue and happiness. "Each time that man increased the potency of his material tools, he was increasing the gravity of the moral consequences of his acts and was thereby raising the minimum standard of the goodness required of him, if his growing power was not to turn to his destruction."

We must address such questions and the distinctions between probable and desirable futures for each of us as individuals, for our nation and for the global community. The dilemmas we will be facing are essentially moral. What kind of society do we wish our technology to create? Not what kind of society will our technology compel us to create?

I have no doubt about Canada's ability to compete once our will is in place. Canada is in a unique position to develop products for the information age. We are the most "worked" country in the world and have the highest per capita investment in telecommunications. We possess an extraordinary banking system and an education system that is among the most advanced in the world. It is estimated that by the end of the 1980s the information processing industry in Canada will account for 10 percent of the GNP and that by 1985, 80 percent of upper and middle class families will have computers. But we cannot have useful technological development independent of appropriate social need.

An information society without a fundamental shift in values would be a further expansion of the present consumer society. Given the plight of the Third World, Western society must somehow (to use a familiar platitude) become more responsible world citizens rather than more consuming consumers.

Our future, any future, is influenced by pictures which people give themselves. The "alternate vision" we will need is not yet clearly articulated and so lacks grass-roots popular support. We can change that; but any new deal must involve technology, and that technology must be value driven. Now is the time.

There are signs that things are changing. We seem to be between waves (to borrow a metaphor from Toffler) seeking "new rules". These new rules are following Whitehead's dictum that great ideas seem to enter reality in strange guises. Productivity, growth, effectiveness, employment, the good life, all these seem to be among the "old rules" that are being reassessed.

Education is the key to our future, because it harnesses our most important renewable resource, human beings. And for it to perform its proper societal role, educators must not lose sight of the difference between process (the potential for a life of learning) and product (the grasp of a specific skill). This means that we must

learn to do both, that is to say we must ensure we are educating people for life (process) while facing the prospect of perpetual vocational retraining.

What better place than through our educational institutions and what better helper than the new technologies. Education remains the single most important instrument of society for shaping values and habits, techniques and systems. Let's not throw the baby out with the bath water. Or to paraphrase Oscar Wilde, let's not become a society which knows the price of everything and the value of nothing.

PANEL NO. 2: QUESTION PERIOD

Jeremy Thorn, National Museums of Canada

I have a question which perhaps Dr. Wagner would be the best person to reply to. You said that knowledge is the capital of the future, it seems to me that if knowledge is the key then it may be that in the longer-term the effective use of technology, robots and computers, for example, may be more important than manufacturing the hardware. So I wonder if in the longer-term future, we really should be thinking not so much in terms of a war between nations in manufacturing hardware, but the next question about software, information content, the know-how in terms of using this technology more than really manufacturing the hardware. I wonder if you see things that way.

Dr. Norman Wagner

Well, very briefly I would agree entirely with what you're saying. As in most cases a balance, a compromise if you like, is the only realistic way in which to go. I certainly agree with your comments.

Margaret Ann Harbour, University of Alberta

We seem to have heard a fair amount this afternoon about women and jobs, but that's as much as I've heard. Not any concrete ideas about what can go on. My concern is that the decisions which are being made about the jobs that women may or may not have in the next 10 years are not being made by women, because there are so few of them in the decision-making process. And I would like to put a fairly simple question to the panel: what are they doing about trying to ensure that the decisions that are being made on women's jobs are indeed being made by the people who are going to be the most affected by them — by women?

Dr. Wendy Dobson

I think I'd better take the lead on that. I'm not sure it matters as much as you suggest. It happens that we are concentrated in certain occupations that are being affected rather dramatically right now, and possibly in the foreseeable future, by rapid change. But I really don't see that if women were making the decisions, that we would be better off. I think that most women I know, want to see more women involved. But I'm not sure that the decision-making process is as biased against women as your question seems to imply.

Mrs. Lucie Pépin

Maybe what she was trying to say was that if there were more women, the approach could be different — not to be biased but the approach would be different.

I.H. Langlands, National Sea Products Ltd.

I think we spent a tremendous amount of time today being unduly concerned about the effects of the introduction of new technologies. I'm just wondering if many people come from industries where our concern might be rather how do we get more of the technology. We come from an industry where our costs exceed what our world customers want to pay for our products. Our salvation is going to come from the introduction and how we use minor amounts of microprocessors, controls, refrigeration and what not. We haven't seen any major sort of things on the horizon that are going to massively assist our industry.

I think I'd like to address a question to Wendy Dobson: are we in Canada going to end up with two types of industries — those industries which are going to be able to benefit, where those technologies we've heard so much about today are going to be applied more easily. Then another whole section, perhaps a more historically stable set of industries where, for various reasons, the application of new technologies is going to be rather difficult.

I'm really a little bit concerned, as if we've been dealing with a monster, and I'm hoping to get frightened by it a little bit more.

Dr. Wendy Dobson

Well, someone said that Marshall McLuhan was the one that coined the phrase about the rear-view mirror. I always feel that economists are looking at a rear-view mirror when they try to talk about the present, let alone the future.

I'm going to fall back into that bad habit by saying that what statistical evidence is available indicates that there is a shift in North America in most industrial economies into the service sector. It's creating a lot of employment and there is the possibility that Canada may end up in the future with a smaller manufacturing sector, a larger service sector and a resource sector. But beyond that, I don't have a refined answer or a crystal ball to answer your question.

Olivier Nicoloff, Canadian Student Pugwash

I would like to point out that I was very pleased to hear a presentation on education because, since this morning, we have been talking about adjustment. We have been saying that Canadian society must adapt to economic and technological changes which are almost upon us, which we already have to face. But we have dealt very little with the fact that the education system in Canada is not really helping Canadian students to deal with these issues. Canadian universities, at present, are providing information, but the information we receive is extremely fragmented, compartmentalized, incomplete.

I feel that we must keep in mind the need to discuss the fact that information does not, in any way, equal training. If we only provide information to Canadian students, who are tomorrow's active citizens in our society, we are not helping them nor the Canadian society after them, to adjust to technological change.

Michael Avedesian, Domtar Inc.

The previous two speakers touched on two comments that I would like to make based on today's proceedings and by way of these comments I would like to solicit the views of this panel or other participants.

My first comment relates to the word "technology" which is being used extensively today to refer to the so-called glamorous hi-tech areas, such as microelectronics and biotechnology and robotics. These are important, but I suggest that we should also include process and product research and development in what I call the bread and butter industries of this nation. And that includes pulp and paper and mining and metallurgy.

I would like to point out that the pulp and paper industry contributes the greatest component of the Gross National Product and also the greatest component to employment. I've been in the industry over the last 15 years in R & D and I'm sad to report that we are slipping in terms of our competitor nations like Japan, Sweden, Finland and the United States and we've got to do something to turn this around.

It's not only the responsibility of the governments but also the responsibility of industry, people like myself, to do something about this. So, I would like you to bear in mind that there are less glamorous areas of R & D and technology that need attention.

My second comment refers to the major theme of this conference, "Canada Tomorrow". I don't think that Canada, and I hate to put this in a negative way, will be a leader in the discovery, development or commercialization of new technology without a very strong university base. The federal and provincial governments must be committed to supporting and promoting excellence at all levels of education, in particular university research. After all, the universities are the umbilical cord which will supply us in industry with the nutrients.

I ask the government one simple question: what is the purpose of building the world's best sports stadium without supporting the athletes to win the gold medals in international competition? I was very pleased to hear George Keyworth this morning state the two priorities of the Reagan Administration — to support new fundamental basic knowledge by way of a 17 percent increase in funding and, secondly, support university training in the areas which they feel will have the greatest impact on their country.

Now, having said all of this, we in industry must also accept our responsibility to Canada's future in the area of technology and we must also increase our commitment to R & D in the short, medium and long-term.

SUMMARY OF PANEL DISCUSSIONS

Dr. Louis Berlinguet, Secretary,
Ministry of State for Science and Technology and
Chief Science Advisor to the Government

Ladies and gentlemen, you have just heard the last speaker of the day. I'm not on the caboose of this train. I'm just one of the dispatchers, so I'll be very, very brief. I think that we heard a lot of good speeches today.

This has been a long day, and I have no intention whatsoever of going over everything that was said today.

I think we have reached some consensus on a certain number of issues and there is still much to discuss on others. The first issue on which we have reached a consensus is that technological change is definitely with us. It is useless to think that we can go back on technological change, which can only increase in both scope and speed over time. Thus, technological change is with us.

The second issue on which we have reached a consensus is that Canada cannot avoid it. By nature, technological change is international. There is competition, as was said this afternoon; Mr. Servan-Schreiber even called it a war. I think it was the Americans who told us "if you want to win the race you have to run faster" so Canada cannot avoid the technological change. So, it is not so much "Why do we have technological change?" but the real question is "How do we manage this technological change?", "How do we manage it in Canada with our own institutions, our own cultural background and our own government, labour and universities?" This is where the consensus stops.

There were several discussions, very interesting discussions, and I hope that tomorrow we'll hear more about it. Number one: on the importance of the social aspects of technological change, we were told that we need more research in this area, more money should be given to research on these social attitudes.

The important role of women in helping to bring about and manage technological change was also discussed.

We were told of the necessity for reaching a concensus between governments, management and labour. Some of you said that management should take the lead, others said government should take the lead. I personally believe that it should be an "entente" between these three very important sectors of Canadian society.

The need to dispel the myth of the "black box" concerning the new technologies, was stressed. In fact, if we accept the new technologies in our television sets at home, I don't see why we shouldn't try to understand the technologies being applied in our factories.

The importance of education was also brought up. We heard several speakers who claimed that there can be no adjustment to technological change without, at the same time and in a very definite way, an education system which can cope with technological change, which of course safeguards cultural values but which also teaches understanding of technological change. I think that what is called public awareness of technology, the attitude of the public-at-large, is important. Managers ask about change and managing technological change. You can imagine what the public is asking about new technologies.

And finally, I feel we must think of our children. It seems to me that we, adults, have known technological change for the past few years and that, psychologically, we are now trying to adjust to it. Could we not, I submit, inverse the process and try to psychologically prepare our children for change; would acceptance of that change not then be much easier?...Those are questions that are not answered.

You have heard several good speeches, but now the ball is in your court. I would hope that tomorrow you'll be loud and clear in voicing your own personal feelings concerning these very important questions. I would hope that a beneficial dialogue will be established in each of the workshop sessions.

GUEST SPEAKERS

Luncheon

THE FUTURE IS NOT WHAT IT USED TO BE

Vern C. German
Chairman, The Canadian Manufacturers' Association

Thank you, Mr. Chairman for your kind introduction. It is a great honour for me to be asked to speak at this conference dedicated to the role and impact of technology on the future of our country. We have heard and will continue to hear for the balance of these sessions, ideas, proposals and wise counsel on the subject of Canada's future in a rapidly changing world.

I am speaking for the manufacturers of Canada and there is no group more interested in "Canada Tomorrow". Indeed, *Future Making* was the title of the submission I made recently on behalf of the Canadian Manufacturers' Association to the Royal Commission on the Economic Union and Development Prospects for Canada.

I have entitled my remarks today, "The Future Is Not What It Used To Be" to point out that, in the manufacturing community, we think things will never be the same again. Manufacturers are the men and women who make the things which turn the wheels of commerce, and incidentally provide the basic fodder for those wonderful statistics by which we all live and die. I am reminded of a saying attributed to the late Marshall McLuhan: "If you torture statistics enough, they will confess to anything." But as a manufacturer, I am rather more fond of another old saying: "Nothing ever happens in business until someone sells something to somebody."

This conference is addressing the fact that the world is not only changing, but it is changing at a rate undreamed of in the past. Toffler's Third Wave, the age of information, and the new technologies arising with it, is indeed upon us. But rather than fear these changes we must meet them head on and recognize the tremendous opportunities they present. We are better to ride the wave, not allow it to engulf us.

How management addresses this Third Wave will, in my opinion, determine whether our economy grows or stagnates — whether we create employment for all who want it or allow continuing unemployment. We can ride high or be submerged. We have to use the new technologies to increase our productivity and competitiveness in the global village. Therefore our greatest challenge is to manage our resources and talents so that we will be in a position to seize the opportunities that lie ahead. We must learn how to manage change, to harness new technology and human resources to produce new jobs.

In so doing we will be evolving an environment wherein the major players in the system, governments, labour and business will be dissolving the old attitudinal fixes of distrust, suspicion and confrontation, replacing them instead with a recognition that mutual dependence is a fact of life — a required dimension of national prosperity. I think we can take comfort from a growing number of signals that this process is now coming about.

Like the two caterpillars: as they inched their way across the grass, one looked up and saw a butterfly fluttering overhead. He turned to his companion and said: "For a million dollars you wouldn't get me up in one of those things." I dare say his perception changed one day. For caterpillars as well as people, change is as inevitable as death and taxes.

One of the biggest changes we must recognize is our increasing dependence on international trade. The recession demonstrated rather brutally just how intertwined and fragile the world economy is. We have to face the fact that the developing countries are taking a larger share of trade in some of the basic manufactured goods. This is expected to grow to an estimated 25 percent of world production by the year 2000.

There is a simple explanation to all of this — cost. The developing countries are exporting more industrial products, particularly in the labour-intensive, simple-to-produce variety, in which they have an obvious cost advantage. To compete, we must face the fact that there are certain things we cannot change. In Canada, we can do little about our climate, our geography, our size of domestic market, or the high cost of our way of life. We just cannot match the labour cost advantages of the newly industrialized nations and so we must first

recognize this and, second, adapt our policies accordingly, seeking out areas where we can make a difference, and where we can realize a competitive advantage.

We can also reduce our costs by turning to the new technologies to regain competitiveness, with all that implies: massive amounts of new investment to upgrade facilities and deal in larger scales; relocation and skills retraining of the workforce; focus on quality and attitudes of management; and harmonizing the roles of labour, management and government in an effort to reduce the appalling waste and costs that our adversarial system has generated.

What does all this mean for Canada? It means that our most important competitor is no longer the plant down the street, but a firm across the border, or quite possibly on another continent. It is no longer enough to be competitive. We must now be internationally competitive.

I wonder how many Canadians realize just how dependent on international trade Canada is. In 1966, we exported about one-fifth of all we produced. By 1982, one-third of everything we manufactured in this country was sold outside Canada. The same story applies to imports. In 1966, imports accounted for one-fifth of all the manufactured goods sold in Canada. By 1982, this had risen to more than 30 percent.

Eighty percent of the jobs created in manufacturing in the last decade were export-oriented. More than one-and-a-half million Canadian jobs are directly linked to exports. Canada's position is unique. With our high degree of industrialization and small domestic market, we depend more on trade than any other industrialized nation. On a per capita basis, we trade nearly three times as much as Japan. Putting all of this bluntly — if we export more, we will build a base for a rising standard of living and we will create more jobs.

But let's look at some of the specifics! On the surface, Canada's trading performance has been fairly strong in the 1980s. For three consecutive years, the degree of import penetration has declined. Canadian industry has regained an increased share of the domestic market in 11 of the 20 major manufacturing sectors. Over the same period, exports have increased in 16 of those industries.

But what about market share? Over a 20-year period our share of exports to the world's major industrial countries has remained about the same. Our share of world trade, however, has dropped from 5 percent in 1970 to 3.6 percent in 1981. This unhappy stituation was caused by strong competition from the newly industrialized countries as well as Japan and other highly industrialized countries — competition which intensified during the recession as everyone scrambled to grab business from someone — anyone — else. So, when I ask, "What does that mean for Canada?", the answer is clear.

If we are to export more, we need to focus on three areas: trade, technology, and human resources management. I position technology in the middle of this economic equation because I believe it is the glue that binds it together. New technologies in both products and processes can give us a crucial comparative advantage. But ladies and gentlemen, I caution you — all the new technology in the world will not make the slightest bit of difference unless it is understood, accepted and implemented by our employees. As managers we must involve our employees in the developing and planning of the new environment that will affect them. We must recognize that they are concerned and apprehensive about the impact of technology. We cannot afford to treat these fears lightly or dismiss them out of hand. Some dislocations will be inevitable, and we cannot minimize the important needs of retraining, skill development programs, and effective communication. And here is where governments can play a very important supportive role.

Quite simply, if the workforce is resentful, or antagonistic, or uninformed, if they are not in every sense partners, the comparative advantage that technology may confer will be diminished, as will our international competitiveness. Our economy will not expand to meet the expectations of Canadians. Jobs will not be created, existing jobs will be guarded jealously and new technology will be resisted even more.

Technology can be the wings that free us or the chains that bind us. The outcome, in the main, will depend on management's response, and the CMA has been devoting much of its resources over the past year to encourage the development of new relationships among the people of our enterprises, and the creation of a greater sense of participation and involvement.

Last year we published a document *Competing in the Global Village - Self-help is the Best Help* in which we explained the need for management itself to develop new approaches to its responsibilities. The response has been gratifying and the results positive.

Management has a special responsibility to initiate greater sharing of the decision making process by bring-

ing workers into direct involvement with operational matters, decisions, and goals and by linking compensation systems to improvements in productivity. While new technology, from time to time, can bring about quantum leaps forward in the competitive race, I am of the view that equally important improvements in the production process are incremental and flow from a great many small efficiency gains that arise from dogged determination, and an open management style that encourages partnership and participation.

Governments too have a responsibility and a vital role to play, ideally supportive rather than directive. I see the primary role of government, in the context we are examining today, as creating a stable, low-inflationary environment, with predictable policies so that the private sector will be encouraged to innovate and invest. As the chairman of Chrysler said a short time ago, business needs all the help it can get — so what's so bad if some of it comes from the government.

In the international trade perspective, governments can be powerful agents of help and we continue to urge a focus on incentives to encourage the private sector in its technology and export programs.

There are important opportunities for fruitful collaboration between government and industry in enhancing our marketing effectiveness abroad. We have probably the finest trade commissioner service of any nation — to aid and promote our commercial interests in many countries of the world. There is concern, however, that other assignments and attention to other matters is resulting in a dilution of their commercial responsibilities at a time of growing need.

Premier Lougheed of Alberta recently told the Pacific Rim Opportunities Conference that a serious problem for Canada is that we have failed to organize ourselves in the best way to export. He was addressing our concepts of competition and combines, and relating them to the dimensions and scale of international competition.

Faced with the growing interdependence of national economies, the lines between our domestic and international economic policies are becoming increasingly blurred. We must stress a multilateral approach to trade negotiations, with a focus on reducing tariff and non-tariff barriers to trade, including bringing the newly industrialized countries into the GATT (General Agreement on Tariffs and Trade).

The spectre of protectionism is an awesome threat to the balance of world trade. Canada has more to lose by this process than perhaps any other country, and so we urge governments to be vigilant and to give battle whenever the threat appears. I would suggest that it would be timely to advocate the establishment of a GATT monitoring system, whereby departures from the rules would be visible to all. I am sure that you would find Canada in the first rank of those honouring the agreements, but all would gain to the extent that the monitoring system inhibited drifts toward protectionism.

I have entitled my remarks today — "The Future Is Not What It Used To Be" — one could just as well say, "things will never be the same again". In national terms I think the essence is that we have become an important trading nation, and the things we have come to accept in our lifestyle and our standard of living depend absolutely on international trade. There is no turning back from this. Certainly our ability to maintain our standards would be zero if we were to lose our trading position.

Turning this equation around though presents us with the most marvellous opportunity. If we were to employ more effectively the tools and relationships we have been discussing: technology, human resources, investment, and national will and cohesiveness, we could improve our competitiveness and then our share of world trade.

Let me put some numerical perspective on this for you. You will recall my saying that we have not been performing well in terms of market share of world trade. In 10 years we have dropped from 5 percent to 3.6 percent.

If this had not happened, and we had just maintained our 5 percent position, we would have now 720,000 more jobs in our economy (half direct and half indirect), and have likely avoided the current unemployment crisis.

Since our competitiveness campaign, like all campaigns, needs a goal, I would suggest that we adopt a target of restoring our old 5 percent share, say by 1990. If you accept this thesis, then I think you will have more than a passing interest in knowing that in the process we will create 1.4 million new jobs (again half direct and half indirect), with all of the positive fallout that will produce for the nation's economy. And as success surely feeds on itself, we then can look forward to a rising standard of living for all Canadians. I believe that this goal can be achieved. It is a goal to which the Canadian Manufacturers' Association is committed.

Given reasonable and supportive policies by governments, a commitment by management and labour to face up to the increasingly competitive and technological world, and a desire for all of the economic layers to work as a team, I have every confidence that we will succeed.

Banquet

Mr. David Golden
Chairman, Telesat Canada

Mr. Chairman, Ladies and Gentlemen. I have made many speeches in my time. I have sat and stood on many platforms in my time. It's the first time in my history that I have been a warm-up act for a famous comedian. It's a new role which I will try to fulfill, but it may take me a minute or two to accustom myself to it.

When I was asked by some of the organizers of this meeting if I would speak at the dinner, I was told that I could have about 20 minutes after which I would be followed by somebody whom the audience would enjoy. I was told, in confidence, that I would be succeeded by Mr. Dave Broadfoot. But I was also told that this would be kept a secret and would not be disclosed, and I am happy to note that in fact it was kept a secret and is known only to the 18,000 people in Ottawa who received the printed program.

However, on reflection, I am grateful that it worked out this way because, as you know, traditionally the lead in a vaudeville act or preliminary to a professional boxing bout is a young man or woman who is felt, as if perhaps with appropriate seasoning, might turn out to have the right stuff.

Thirty or 35 years ago, I was adamently and vehemently in favour of compulsory retirement at 65. I find that my views have changed and I now scan the Charter of Rights avidly to see whether, in fact, such a rule is not illegal. With your permission, I will bring to the attention of my board that at least in the minds of some, I am ready to embark on a career as a neophyte and I thank you for that.

Every speech is supposed to have a theme. Winston Churchill, you will recall, applied this to inanimate objects as well and he once toyed with a pudding put in front of him and pushed it to one side and said: "I can't eat this pudding... it has no theme". I welcome stories about Sir Winston for another reason, because at the end of a violent argument, many years ago about some event in which he played a prominent role and he and his friend could come to no agreement, Sir Winston said: "Well, enough, let's not discuss this anymore; history will decide who was right and *I will write that history*".

I have recently undertaken to writing a history of Telesat Canada. And I can assure you that on the publication of that document, it will appear that all of the decisions that have been taken in the past 15 years were not only right but it is unbelievable that anyone could ever have questioned their rightness at the time.

I thought of two themes: the first one was taken from that famous essayist E.B. White who said: "I hold one share in Corporate Earth and I am uneasy about the management". I rather like that, but then it occurred to me that that might be taken as having some political connotation and I have no such connotation in mind and therefore I move away from that.

I noticed recently that the Right Honourable Harold McMillan at the age of 90 is reminiscing for the BBC and he said: "The object of work is *leisure*. The object of work is not to go on working." And I thought that I might take that as my theme, but if so I would then have to announce a theme and sit down.

So I decided to take a third theme which is that, if everyone is moving in the same direction it's time to stop and think.

The first thing is to avoid the temptation to move too fast. You will recall that shortly before he died, Chairman Mao was asked to assess the influence of the French Revolution on world history. He thought for a moment and he then replied: "It's a bit early to say."

Lord Keynes during the Crash of 1929 was asked if such terrible events had ever occurred before. He thought for a minute, and said "Yes, it lasted for 400 years and was called the Dark Ages". I am also reminded of the ancient Chinese curse: "May you live in interesting times".

I want to say a word about computers. I realize that I am in the minority, I doubt that they are likely to last very long. However, on the assumption, which I believe is erroneous, that they may be around for sometime, I keep hearing about computers talking to computers. I don't know what they are saying to each other. If they are saying something useful, I defer. I have a feeling that many of them are saying to each other the words of that rather popular T.V. program of some years ago: "We have to stop meeting like this".

The same way, I have grave doubts about the information society, whatever that may mean. As far as I am concerned, I already know far more than what I can possibly use no matter how long I may live and I can't conceive why I should learn anymore. What I would like to do is to be able to hang on to a fairly minute proportion of what I already know. As your marbles go, one by one, you realize that is an accomplishment.

Now there are a lot of different views on how to handle new technological advances. Bill Turner, the Chief Executive Officer of Consolidated Bathurst, and I were on a panel sometime ago and he came up with what I think is a very apt description. I promised him that I would use it at every opportunity and said I would try to remember to give him credit. He said there is this scenario about a new invention. The British invented it on Monday. The Russians on Tuesday say that in fact, although they have forgotten to mention it, they actually invented it the previous Friday. The Americans on Wednesday say they will produce it under license, the Japanese on Thursday deliver the first item to Vancouver, on Friday the Canadian House of Commons has an emergency debate to see whether it's a federal or provincial responsibility.

Because they could get me for free, they thought that I was going to stand up here and not mention Telesat — other people have made that mistake in the past — and I am going to discuss briefly the Telesat Canada experience, because I think it is germane to some of the things that we have been talking about for the last two days at this Conference. We were, after all, the first domestic satellite communications corporation in the world based on geostationary satellites.

One would have thought that, despite the ability and dedication of our scientists and our engineers, the main problems would have related to the launch, earth stations, the satellites themselves, the computer programs for station keeping...in other words, all of the hardware components, which I am happy to say I don't understand. In fact, just the reverse was true. All problems in the area of hardware of high technology were either foreseen (which, I take it, means to see ahead of time) or if not foreseen were solved later. The system was started on time and has worked extremely well ever since through a succession of different and larger satellites, through a succession of different technologies on a vastly expanded scale.

The difficulties occurred in the software. We discovered that people, institutions whether regulatory or governmental, business practices, all these are less tractable and more rigid than we had supposed. Our problems turned out to be people-oriented and societal, rather than technical. The software and not the hardware is where you have to concentrate your efforts.

We do consulting all over the world as a result of our leadership in this area and we try to tell people the laws of physics are known, the laws of politicians are not....Sorry Judy (Erola)! And other things. I don't want to single out politicians, but it is these societal things that cause the problems. And what to use the new technology for?, what is it designed to do?, is far more difficult than how to actually build hardware and make it operational.

Now, I am an amateur in these matters, I happen to have had a lot of years of experience but I am an amateur in these matters. And I am always happy to be reminded of the sign in the do-it-yourself shop: "Remember, the Titanic was built by professionals, the ark by amateurs". And when I think of the Titanic, I remember that it is said that John Jacob Aster was in the bar when the iceberg struck and he explained to the bar steward, "I admit I rang for some ice, but this is ridiculous!".

I wonder what signals we are giving our educators and our young people, and if they are the right signals to give. Today to be technologically illiterate is to be incapable of taking advantage of the better job opportunities and the more challenging tasks in society. At the same time, I am profoundly aware of the view that we are moving into dangerous territory if we ignore or denigrate humanities.

As the world becomes more crowded, more complex, more interdependent, a knowledge of history, the thoughts in the backgrounds of other people, of economics of philosophy, of man's relationship to his environment and more, become more and not less important. Even more fundamentally, all the machines and technological wonders of the world will avail us little if we lose the ability to think clearly and to transmit those thoughts to others in unambiguous and precise language.

I am almost persuaded sometimes, that one could make a case for requiring the study of Latin to be compulsory so that new generations will understand the use and abuse of the English language. The late Stephen Leacock used to use his knowledge (or shall I say, abuse his knowledge) of Latin in two ways. After a long and distinguished career at McGill, he was appointed Professor Emeritus. Somebody said: "Professor Leacock, what does Professor Emeritus mean?" He said: "It's very simple, it comes from two Latin words, one

latin root and one latin word - 'e' out and 'meritus' - deservedly so." He also categorically refused to speak in any hall that was labelled auditorium. When somebody asked him: "Why is this so?", he said, "Well surely, you must know your Latin?. Auditorium comes from two Latin words: 'audio', meaning I hear and 'taurus', the bull".

I'm grateful to Don Johnston who has asked me to share some of my views with you tonight. I want you to know that Don Johnston invited me.

I'm reminded that long before the invention of the radio or the television, in a small Welsh mining town there was such an avid desire for learning, that despite a long day in the pit, once or twice a week they used to meet soon as they were washed up after the day's work and to hear a speaker on some topic that would enlarge their knowledge of the outside world. In this particular time they gathered in the chapel and a young professor from the University of Aberystwyth arrived and he spoke on his subject. He was a professor of the English language and literature and he spoke on the use of the middle 'E' in Chaucer's English. He was a great expert on this subject and he spoke with clarity and conviction for an hour and 40 minutes.

He then sat down and the miner at the back who had been charged with the responsibility of thanking him got up and said: "Professor, we find no faults with you, you came here a long distance to speak to us and you spoke with great conviction about the subject about which you obviously know a great deal. We have no fault to find with you at all. However, on behalf of all those present, we say: "To hell with those who invited you."

WORKSHOP SUMMARIES

THEME 1: TECHNOLOGY IN CANADA'S FUTURE

Dr. Stuart Smith
Chairman, Science Council of Canada

Given the generality of the theme, we chose to speak in terms of principles instead of specifics. I think you, the participants, tried to adjust yourselves to where Canada stood vis-à-vis our international competitors. You looked at protectionism as a possibility and in fact, rejected it. You looked at the question of whether we had to move full speed ahead, or whether there were choices; whether there was a possibility of moving more slowly in some sectors where jobs might be at risk. These were issues you dealt with and there was some agreement and some disagreement. In some instances, the disagreement may be between 700 of you and me, but I regard that as an indication the matter is not settled.

I think we agree that the nature of the world economy is changing rapidly and particularly that it is far more highly competitive than ever before. You also have felt unanimously that we could not take for granted that the market for our natural resources, and the real prices we can command for them, will necessarily be all that favourable. As well, there seems to be a feeling that we cannot rely as much as we have in the past on our rich natural resource sector to carry the entire burden of our international trade and balance of payments. We all believe that natural resources will continue to be the hallmark of Canadian economic participation in the world economy, but that it can't be taken for granted.

All of you have expressed the view that new technology needs to be applied in these traditional resource industries, so that they remain competitive. It was mentioned that we can expect competition from Third World countries and therefore it's terribly important that we adopt policies — which don't merely support so called high-tech companies in isolation — but that specifically support developments which will allow new technology to be applied in our traditional industries.

People made the point that it wasn't just a need to develop technology, but more importantly to apply it properly. It was pointed out that much of the technology we apply will be imported, and what we have to do is find satisfactory ways of introducing this foreign technology into our country. The interesting point is that some of the workshops have tried to deal with the issue of whether one can be a good applier of technology, if one is not also a good developer of technology. In other words, do you need to develop your own technological capacity in order to understand better what it is you are bringing in and applying? Furthermore, do you need to have cards of your own to play at the international table if you want to be part of some of the joint developments going on in technology — not simply get what someone else considers obsolete and that they are ready to sell to you once their own factories have taken on something newer.

So there is a general feeling that Canadians cannot simply rely upon importing technology, that we must develop some of our own — if only to be part of the technological game that enables us to import technology more effectively and use it more efficiently. There is additional agreement that the new technologies certainly are not just those related to information processing in microelectronics. We have to recognize that advances in biotechnology, materials science, remote sensing, lasers, and so on, are of very great importance for Canada — in some instances even of greater importance than the information technologies themselves.

As it happens these technologies multiply each other: so when you get an advance in lasers, that advance in lasers permits a new generation of microchips; and when you get a new generation of microchips, well that permits a new generation of lasers to be developed. These things cascade one upon the other, that's why a number of us have said that we really sit at the threshold of a golden era in the advancement of 'human knowledge'.

More new human knowledge is likely to develop in the next 10 years than in all of the history of mankind put together. It's staggering to think of the new products, the new processes and the new possibilities that will be in front of us in a decade or two. It's because all these new sciences are moving together and each helping the other one advance.

So Canada should not focus narrowly, but should try to participate with breadth. The other thing you want is for Canadians to try to develop excellence. We cannot cover the waterfront, but we should try to develop excellence. Where we have excellent people, we should back them to the hilt — that's what you have said in every workshop, and I believe that message is something which all of us must understand.

You have also said that Canada must not rely on protectionism — this seemed to be virtually unanimous. You seem to feel that protective devices could invite retaliation and that our new technology industries would themselves be shut out of markets around the world.

It seems to be your view that Canadians must become aggressive world traders and world marketers — that we cannot rely on the old formula of tariffs trying to close our borders as a means of developing our economy. You feel that if any protection is used, it should only be for a very short term. You also feel almost unanimously that if protection or support is used, it should not be for declining industries, but rather for new ones.

It seems certain that there is a role for government, and all of you agree that it must support research and development. You agree that government must transfer technology from government labs into industry and from universities into industry. Government must support small businesses, and it must share the risk for those businesses. Government, you have also said, must train people and you have noted a lack of training with an entrepreneurial flair. Canadians need to get used to an entrepreneurial mentality as something which perhaps we didn't need to do in the days when we could rely on our natural resources more thoroughly.

We also see a role for government in the arranging or gathering and sharing information. The general feeling is that neither business, nor workers, nor citizens generally can possibly have at their disposal all the information needed to make an intelligent decision in today's world. In this regard, government has a real role to play in the building up of data banks, and making them accessible on a real time basis to business people and people generally.

There is one main area of disagreement, which I have to point out. Most people at this conference have expressed the view that Canada must find special niches for itself, that we have to find areas where we can be particularly expert. This is not unanimous, but most people here have the feeling that Canadians have to find special areas within the knowledge-intensive industries where we must specialize. It's usually expressed by saying we are not going to take on the U.S. or Japan in the fifth-generation computers. We have to find a particular aspect of the new artificial intelligence area where Canadians can specialize.

The difficulty is that there is also a deep distrust among most of you when it comes to the government choosing areas of specialization or when it comes to government running businesses. Many of you prefer a mechanism which you refer to as the 'market mechanism'. Other people here have the feeling that the market has not put Canada into these high-growth knowledge intensive areas, and that the market is an imperfect mechanism where Canada is concerned because it operates on a North American basis. It assigns no particular dollar value to something happening in Canada, unless it happens to be in association with an obvious Canadian industry such as the natural resource sector.

Some say the market should be allowed to choose Canada's area of specialization. Some believe there must be a role for government, at least in consultation with the rest of the economy, to try to put its limited resources into those areas of specialization which have the greatest chance of Canadian application and success. Presumably, this is not something we are going to resolve today. It is an area of disagreement reflecting the deep distrust of government along with the Canadian dilemma of how a North American market treats a country which, like Canada, is in need of specialization. This is a difficult situation. It is not something that theologies or ideologies can resolve. Canadians are going to have to deal with and come to a reasonable use of government. We have a mixed economy and we are going to have to learn how to use it properly.

A rapid and efficient consultative mechanism, by which areas of specialization can be identified and supported, seems essential to Canada's participation in the new industrial order. That mechanism has yet to be identified, but perhaps it should be the focus of our attention as a nation.

In summary, I would say that when you were looking at "Technology in Canada's Future", you were in an optimistic frame of mind. When you were considering Theme 1, you could see the potential for Canada. You saw no reason for an advanced country like Canada to feel itself somehow dealt out of the technology game.

It was felt that new technology can and must be applied in our traditional industries and that we can and should not hesitate to compete world-wide, certainly in our areas of particular strength and ability. It's an opti-

mistic message, but undoubtedly in other workshops we will hear about the job displacement issue and some of the worries we all have.

For Theme 1 at least, this is an optimistic conference. Mr. Minister and other Ministers I want you to know that the message this conference is giving you is that Canada must move full speed ahead in the application and, to some extent, the development of new technologies. We should not rely on protectionism. We should have confidence in ourselves and work together to take on the international competition.

THEME 2: CONCERNS ABOUT THE CONSEQUENCES OF CHANGE

Ms. Heather Menzies
Freelance Writer

Overall, the mood of the workshops was upbeat. The consensus was that the opportunities outweigh the problems; that we'll weather the transition period all right; that we should get on with the job of winning the race for technology. There was a strong sentiment that we can't be both competitive and compassionate simultaneously, only sequentially: by being competitive, we can create wealth and use that wealth to be compassionate. There was little discussion about job losses, redundancies and deskilling, nor was there much specific discussion about new areas of possible employment growth. There was little discussion about women either; for instance, it was never mentioned that two-thirds of working women are concentrated in three occupations being severely diminished and substantially transformed by automation.

Stressing the positive, workshop participants touted the technology as a solution to Canada's endemic dilemma: too much geography and not enough people. Regional disparities could be diminished; economies of scale are less important.

One of the most frequently expressed concerns dealt not with the nature of the change we're experiencing, but the unprecedented speed of it. Can we cope with such rapid and ubiquitous change? Or rather, are the coping mechanisms currently available sufficient? Just trying to measure the rate and impact of the change, trying to analyse and plan technological change seems to have overtaxed the system and the tools we use, it was suggested. In applying the technology, many needs are not being met, for instance the need for better linkages between centres of research and traditional, existing Canadian industries wanting to modernize and apply new technologies; the need for better intelligence on possible marketing opportunities, particularly in the developing world; the need for planning and nurturing growth, not reacting and protecting redundant industrial processes and technologies. There were also many needs regarding the application of new knowledge and skills — most notably a need for closer liaison (interface, as the workshop participants put it) between learners and workers, or centres of learning/research and centres of work/applied technology. In a third category, mechanisms are needed for redistributing the benefits of productivity to the "losers" — those who would be left behind in the process of technological change.

Although there wasn't a great deal of discussion devoted to those who would lose out, there was some. There was a consensus that certain occupational groups, and possibly even certain regions of the country would tend to bear rather more of the negative consequences of change. The groups mentioned were women, youth, older workers, natives in Western Canada and the North and the 30 percent of adult Canadians who are functionally illiterate. Sometimes these groups of people were referred to as "marginalized" people. For instance, women are often referred to as on the "periphery" or the margin of the workforce by virtue of their heavy concentration in part-time and temporary jobs. Women represent 75 percent of part-time workers and about 85 percent of temporary workers. When technology makes work redundant, a temporary worker isn't laid off; rather, her work term just isn't extended. It is the marginal workers who are the most vulnerable.

There was a general assumption that the social safety nets would take care of those people who are dislocated by technological change, as well as a related assumption that these people would be content to languish there — although the recent troubles in the Gaspésie would tend to challenge that assumption, I think.

There was also some concern about polarizations in the Canadian labour force and a related retreat from the principles of equalization. Although working at home via computer terminals and phone lines holds many positive advantages, representatives of women's groups worried that it could herald a resegregation of women and women's work inside the home unless protective policy measures were implemented to prevent or mitigate this. There was a related concern over an eventual shake-down in the high-technology industries, producing a greater gulf between have and have-not regions and countries. IBM and the other giants might swallow up many of the small ventures which are heralding such a bright future for Canada — the deregulatory rhetoric of George Keyworth on Monday having perhaps been a factor sparking that concern.

There might also be a have and have-not situation in occupations and skills. Several workshop participants worried over a possible bimodal distribution of the

labour force, with a relatively small technical elite of knowledge workers using technology in creative value-added ways and then a large mass of relatively unskilled people doing menial work — for instance, in fast-food restaurants, as janitors and domestics or some other of the 20 occupational groups cited in a U.S. Bureau of Labor Statistics report (published earlier this year) as likely to provide the bulk of new jobs during the 1980s — and all of them requiring few if any skills. For any who have read *Player Piano*, such a prognosis is chilling. A labour representative in one workshop predicted that only 20 to 30 percent of the population would have meaningful work, and warned that a class struggle could ensue. But he was the only labour representative in that workshop and no real discussion of the issue developed. Discussions on the special adjustment needs of women tended to suffer similarly from the slim representation of women at the conference.

Similarly, the issue of trans-border data flows was mentioned but not dealt with in any detail. Some workshops touched on the issue of privacy — access to personal information — and the need to find a balance between guarding information and sharing it for the benefits derived from that.

Canadian management came in for some criticism in some workshop discussions with some even using the term "inept" to describe its deficiencies. Managers tend to be too short-sighted, to not emphasize marketing enough, and to connote management with control rather than long-range planning and the true managing of change.

Governments too were criticized. Workshop participants seemed to feel that the post-war model of government as welfare state, providing everything, no matter what, is no longer viable. From having largely concerned itself with redistributing wealth, it was felt government must move to helping plan and bring about the generation of wealth. From a reactive role protecting and propping up Canadian industry, participants anticipated government moving to a more pro-active role providing the enabling environment for innovation and new industrial initiatives. This will require more long-term planning freed from partisan considerations — one assumes on industry's part as well as government's.

At least half of the workshop discussions dealt with education: the challenge of mobilizing Canadians in a wholesale readjustment re-education, retraining process, essentially during this decade. Almost universally, participants criticized a too-specialized skills training approach as inappropriate, and instead they called for a solid basic education as the best basis for flexibility. Participants called for not only a new approach to the content of education and training but also for a new role of education in society, a new approach to it and a rethinking of who's responsible for education.

Content: There was a call back to the basics, but redefined as good communication and listening skills, good reasoning skills and an aptitude for rigorous thinking for problem solving. There was a strong feeling that we have pursued training at the expense of the broad goals of a good liberal arts education, and that such an education is particularly important today to prepare people for the value judgements associated with finding the appropriate roles for the new technologies in our society, and defining the limits and the moral signposts in such fields as genetic engineering. Coping skills were stressed, as well as the need for more relevant career counselling, particularly among young women.

The role of education: Here participants stressed the evolution of education from something fairly static and completed by age 18 or 21 to a process of lifelong learning, with attendant implications for personal responsibility, for human resource planning and policy making — for instance, paid educational leave. The status or importance of education/learning in our society must rise in tandem with our need for a knowledgeable, adaptable and innovative population, which will be the key natural resource of the emerging knowledge-based industries.

New approach to education: The thrust of education is shifting from what to learn to how to learn. Informal learning must be acknowledged and given more emphasis. Touching on this, co-op work-study programs are seen as a model for the future, allowing for a closer linkage between research and application, between learning and working and the McLuhan concept of learning a living.

Responsibility for education: There was a surprisingly broad consensus that while government-funded education should emphasize the basic and generic skills, industry is better placed to look after applied-skills training, where general abilities are adapted and fine-tuned to a particular working environment. Although Canadian industry has traditionally provided only minimal training, some of the new high-tech companies' training programs indicate that this is changing.

While education got a thorough airing, questions related to the organization of work and jobs did not. Regarding predicted job losses and technological unemployment, the general feeling seemed to be: we've heard enough about the negative aspects; let's get on with the

opportunities. In one workshop, an academic involved in business administration remarked: "We're here to talk about profits."

I mention this because it leads me to what seemed to be a larger, more philosophical theme running through all the workshop discussions. This theme could best be described as a general sense that we not only need new answers but a whole new approach to solving problems, one that stresses process rather than product and frees us from the boxes of fixed institutions and structures. Workshop leaders reported a common frustration with the narrow circle of established interests which thwarts dialogue in a common frame of reference. Instead, educators are over there, management industry is over there, labour is over there and God help you if you're not represented in one of the little boxes. A related concern dealt with the set stages of antagonism and confrontation between government and industry and, particularly, labour and management. Many people lamented this antagonism and how it compounded the difficulties of dealing with technological change. The solution lies in the direction of "interface". This was the word used most often by participants, who called for dialogue and cooperation among the major actors in our society: government, educators, industry and labour.

I think this speaks to the most pressing need of our time: the need to move away from an atomized model of society to a molecular model. One not of isolation and separateness but one of infinite interconnectedness. I think this was what Dr. Fulton was getting at in her speech when she talked about the threat of nuclear annihilation as our most pressing global concern. It is when we make the connections that we move to the point of rejecting the application of science and technology, in ways that threaten life. It is when we move toward an organic, holistic, molecular vision of interconnectedness and interdependence that we will solve the nuclear question, eradicate pollution and manage technological change properly — that means by harmonizing and reconciling the technical and economic priorities with the social and human priorities, by combining compassion with competition.

On that note, one of the workshop participants told a delightful little story about how important it was to maintain good labour relations in his high-tech manufacturing firm. If he's halfway around the world and gets a report that the rejection rate of products is up, I can predict, he said, that morale is low. Morale and quality are interconnected, he said.

I could end on that nice up-beat note, but after a lot of soul searching yesterday afternoon after reviewing all the notes for all the workshop sessions, I concluded that I would be dishonest if I did. I recall chatting with a couple of the workshop leaders after we'd done our debriefing, asking them how they felt. They felt pleased at the confident tone emerging from the discussions. How did I feel? I shook my head. I wondered whether that pleasing tone of confidence was valid, since we'd spent so little time talking about job losses for men as well as women, deskilling, the health and safety issues and so on. I worried that the upbeat note had been achieved at the expense of full participation by labour at this conference, at the expense of looking at all the items in our management-of-change mandate.

We mentioned dislocations and redundancies, but only as concepts; we didn't take a hard look at the reality behind the words. In the telephone industry, in 1981, Bell Canada closed a number of offices across Québec, "displacing" 40 women in Ste. Agathe, 27 in Thetford Mines, 24 in Sorel and 54 in Québec. In Ontario, in 1981, 12 jobs disappeared in Dryden, 16 in Fort Francis, 43 in Hamilton, 30 in Thunder Bay and 63 in Toronto. In the banking industry, I understand there have been over 1,000 clerical positions terminated this year in one bank alone during a substantial reorganization of work related to the integration of its computer-communications systems. Some middle managers are also being replaced by computer specialists, with an average salary saving of $6,000 a year. During the 1970s, there was a 30 percent drop in clerical/secretarial staff at the University of Calgary when automated information systems were introduced there. (This reported in a study by Stephen Peitchinis of that university.) In the garment industry, 300 women in a Hamilton, Ontario factory were laid off this past year due to automation.

We didn't take a look at the automobile and agricultural machinery industries where thousands of men have been laid off because of the recession, but where technology might result in their never being recalled as the economic recovery prompts investment in automated systems. We didn't look at the two phases of technological change, such as in computerization: the first stage, automation, usually involves replacing manual and skilled work with automated systems. The second, which involves applying the technology in innovative new ways to enlarge the scope of economic activity and employment, usually lags somewhat behind the first.

We didn't deal with THE issue of the 1980s: jobless economic growth, an issue which has been well documented by Russel Wilkins among other researchers. But most importantly, we didn't really bring the discussion down to earth by dealing with real people in real

time, now. I was reminded of the importance of this on Monday evening when I had the pleasure of sitting next to Mr. Johnston at dinner and he asked me: but what about the bank teller working down at the corner of Dorchester and Greene in my riding? Yes, that's where it starts.

Well, let me contribute a small story on this line. I went up to Ste Agathe last year to talk to some of those 40 women who used to work as telephone operators there. I met with four of them, spent a good five hours listening to their story. Oh! I got all the background too — how there were still people around who used to get the operator to call to wake them up to go hunting in the Fall; or to find out what time it was. I also found out that they learned of the impending closure (which had been in the works for years) just a few months before it was to happen, and then it was by chance, through the grapevine. Then, well, the contract called for them to get retraining and to be redeployed. But then they found out the re-employment guarantee was only for another operator job, and of course there's not many of those jobs opening up. Then they found that to get retraining they had to qualify for another job, and to qualify they had to go through a humiliating batch of tests. It hurt their pride. But the worst, in their opinion was what happened at the very end. The local manager arranged a farewell luncheon. It was held in the office, half empty of furniture and equipment. Recalling the day, the women told me about the sandwiches that were served, and then as a final gesture, they were each given a rose. A plastic rose, the women told me. A 15-cent plastic rose, they told me. It was their final humiliation.

In telling that story, I'm not trying to spoil the conference, but to test the hypothesis that we have reason to be optimistic at how we are managing this transition period. Despite the rather bleak note I have just introduced, I am confident that we will succeed, that we will turn the modern technologies into opportunities for Canadians. But we won't succeed if we hide away from some of the tougher aspects of the challenge we face: the full social adjustment challenge. That requires coming out of our isolated corners, our isolated boxes and involving all the participants in the dialogue which workshop participants felt was so urgent. In fact, Canadian business managers have already moved toward this dialogue posture. In the last six months, and here at this conference, one finds industry leaders acknowledging that to put the new technologies to work, you have to involve the people whose work is to be affected by them; involve them in planning the change process, reorganizing work and identifying re-education and training needs. With a purely technical focus on change, you might get a computer system up and working. But it requires a socio-technical approach to put that computer system to work, to really exploit it.

Finally, trade unions have begun to extend their focus from jobs to broader employment and economic questions. If Jean-Claude Parrot had been at this conference, he might have talked about the survey that the postal union conducted among its members to get their ideas on what new work postal workers could take on. They got quite a list — everything from meter reading to electronic mail services. Now they're trying to use those suggestions as the basis for negotiating new employment opportunities for their members.

I like to think that if we had had a better representation of labour, and of working women too, we could have begun the dialogue that must replace confrontation and antagonism. I'd like to think that it will start soon.

THEME 3: PUTTING THE TECHNOLOGY IN PLACE

Dr. Roger Blais
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The 20 interdisciplinary workshops held yesterday involved more than 700 experts from industry, government and universities from all parts of Canada. They revealed a strong consensus about a number of factors:

a) Canada has practically all the essential ingredients, including absolutely first-class people, for developing and benefitting greatly from high technology developments. (Note that we have favourable geography, including our proximity to the world's largest industrial market; large natural resources at our disposal; an educational system that is probably as good as anywhere else even though it is undernourished; high retained earnings, and so on and so forth.) However, new technology involves risk. Who will take it? Manage it?

b) What we need most importantly is the collective will to make these good things happen. For this, major impediments must be removed;

c) What is most crucially needed now is for Canadians to earnestly believe in themselves, to develop technological superiority in a number of key areas and thus, to invade successfully a number of lucrative world markets;

d) In other words, we have to learn quickly to put our act together with more cooperation between the major players; we must stop fighting and attacking each other. Greater emphasis on individual initiative is warranted through human resource development, tax incentives, and financial assistance to talented entrepreneurs. Furthermore, Canada should implement as soon as possible a system of full portability of pension benefits and labour decrees in order to allow for the mobility of our workforce;

e) In a world of stiff international competition, we need to reach the critical mass needed both in R&D and the worldwide commercialization of our best technologies. There is a strong feeling of the need to support commercialization by extending R&D incentives through government and private sector procurement;

f) For this, government ought to encourage the firms that are likely to be the *winners* in this tough international competition, that not only have the technological expertise but also the managerial know-how and the knowledge of world markets to make these things happen. Often, foreign sales depend on suitable financing arrangements; and

g) Importantly, we need to maintain a good education system, dedicated to scientific excellence and socio-technological relevance.

In order to ascertain our collective position both at home and in world markets, there is a great need to remove as quickly as possible a number of major impediments to our national effectiveness. Simply stated, we must move from an economy of confrontation to an economy of concertation. This applies to no less than six conflictual areas: the public sector vs the private sector; the federal government vs the provincial governments; the competition between the provinces themselves and the Territories; the conflictual situation between management and labour; the clearly insufficient concertation between enterprises themselves, as well as between them and the financial sector; the financial institutions need to understand technological innovation better in order to know how to fund it; and finally, the growing marginalization of our universities vs society as a whole.

Unless something is done rather quickly to resolve these conflictual areas, the Canadian situation might well continue to deteriorate, with its inevitable harmful consequences on unemployment, inflation, lower standard of living, inability to pay for our health care and other social benefits system, disillusioning and demotivating of our young people, and so forth. There was general agreement among the participants that labour ought to be gradually introduced to the technological changes and that a constructive dialogue should be established with management to resolve the contentious issues. Management must accept responsibility for this as well as for upgrading process technologies.

In fact, whether we like it or not, we don't have the choice anymore. We must put our act together, other-

wise we will be literally swallowed by technological developments occurring outside of Canada and we will have to pay a dear price for our own complacency. Thus, it falls on our political leaders to call for this concertation. A new deal for Canada has to be worked out, government is called to lead a tripartite process of change with active labour and management participation.

This emergency requires the effective teaming up of our private sector and the public sector, and a constructive, well-targetted, meaningful and lasting liaison between labour and management. The concertation must be carried out on a reciprocal basis. If we don't do this, the foreign investments will not be forthcoming and the jobs we need so much will simply not be created.

Never before in our history have we been so threatened by international competition, especially in the light of ever-accelerating technological change. As the Chief Scientific Advisor to the President of the United States declared last Monday, in this race of technological progress, we simply have to run faster than our competitors, otherwise we will be disqualified!

In every segment of our society we feel the impact of technological change. Our basic problem is to be master of that change rather than be a servant to it. In this regard, it is somewhat anachronistic that for every 10,000 of population, we have 100 times less engineers than Japan, which is one of the world's leading industrial powers of to-day. In our technological world, it is also significant that per 10,000 of population, we have in Canada only 1.5 more engineers than accountants and lawyers put together, compared to 100 times in Japan, 8 times in France, and 4 times in the Federal Republic of Germany.

To make matters worse, our investment in national R&D per capita is only one-half of other industrial countries and our private sector contribution to national R&D in terms of percentage of Gross Domestic Product is only about one-third of that of other industrialized non-military powers. Furthermore, according to the most recent statistics of OECD, our contribution to university research in sciences and engineering is only one-half of what it is in other industrialized countries in terms of percentage of Gross Domestic Product.

We need to invest in our future, even at the sacrifice of having a bit less today in order to have much more for our children tomorrow.

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A deliberate concertation needs to be established between government, industry and universities, especially the latter two (teaming the curiosity-oriented people with the market-driven groups). To summarize briefly the results of the 20 workshops, the three main sectors will now be reviewed.

For many reasons, we consider Canadian industry to be the major player in putting the right technology in place, and for this, it ought to have the full support of government and academia. Therefore government, both at the federal and the provincial levels, must provide the proper environment for Canadian industry to prosper and stop substituting for the private sector. It was suggested that the tax system should stop viewing entrepreneurs as a revenue source and encourage them instead.

In order to be competitive in world markets, Canadian-owned companies need to reach critical mass and develop an aggressive and well-orchestrated marketing strategy and deliver high quality goods and services. Exports of fully manufactured goods should be one of our top priorities as our deficit in the international balance of payments for these products has reached catastrophic proportions: more than $20 billion, costing us more than 500,000 lucrative jobs.

Both federal and provincial governments can provide a tremendous boost to threshold companies by providing them with competitive procurement contracts for high technology. For example, it just does not make sense that with our sophisticated health care delivery system, which is one of the best in the world, we are still very much dependent on technology-intensive imports of biomedical instruments and apparatuses to fill our needs. It was suggested during the workshops that the burden of proof should be on bureaucrats if they do not want to purchase Canadian-made equipment which meets the specifications.

The government procurement concept is even more valid when taking into account the fact that Canada, fortunately, spends relatively little on military hardware. Whereas the United States, the United Kingdom, France and the Federal Republic of Germany spend about one-half of a percent of their Gross Domestic Product on armaments and space, vs Canada at 0.05 percent, our country would be well advised to spend the equivalent money to support bold high technology endeavours supported by consortia of Canadian-owned companies and large firms of consulting engineers. At the same time, the Canadian government should find ways and means of encouraging multinational firms to establish plants in Canada, but with world-product mandates and establishing R&D facilities in this country.

It was also the feeling of the various workshops that all Canada-based companies, large or small, are affected sooner or later by technological change. Inasmuch as we have in Canada more than 35,000 small manufacturing firms, which provide for about half of the employment and the value added in the manufacturing sector, and which are regionalized from coast to coast, it was felt that these new employment-generating companies should not be sacrificed on the altar of high technology. Thus, a concerted effort must be made to upgrade the quality of their management, improve their financial position, assist their technological development and promote their innovation capabilities and their ability to export. They should be provided with easy access to information, including the very important information contained in patents delivered in Canada. Perhaps the National Research Council (NRC) should play a leading role in this as it already possesses the necessary infrastructure.

Finally, there was a widespread feeling that industry is over-regulated, that the industrial assistance programs are too complex and that the present fiscal regime for manufacturing industry is too onerous. It was suggested that we may have to abandon combines legislation and competition policy in order to encourage Canadian industries to cooperate. If we do this, do we have to jettison social policy goals?

The role of government was discussed at some length. It was recognized that government often needs to become more active, especially in its role as "honest broker" between the various parties. One area of possible improvement would be the more effective integration of regional aspirations and capabilities into federal activities leading to the necessary concertation of efforts of different sectors. In this regard, the federal government could, jointly with the provinces and industry, establish a number of centres of excellence in high technology across the country. However, it should also seek novel ways to integrate the private sector into these initiatives, and render these jointly-run institutes of technological development semi-autonomous from the federal bureaucracy. There was also general agreement that government R&D should be more directed to the needs of industry than in the past. The work of the provincial research organizations was praised by many, who saw them as an indispensable mechanism to support technical development of small manufacturing firms. However, they do not all receive sufficient funding from their respective governments.

With regard to our institutions of higher learning, we probably have in Canada a number of excellent universities but nearly all of them are now critically undernourished financially. Essentially their purpose is to educate the mind. They should not yield to short-term pressures. However, the universities need to rationalize their operations. They should be encouraged to establish technological institutes with industry funding while maintaining a strong capability in fundamental research. Another major aspect of the universities is for them to adapt to the changing employment situation and, especially, to cope with technological change. Nowhere is this need more urgently felt than in the faculties of science and engineering, as well as those in management.

As noted before, the level of funding of university research in science and engineering in Canada in terms of percentage of the Gross Domestic Product is only half of what it is in other industrialized countries, which is indeed a deplorable situation. The proportion of Master's and Ph.D.'s in engineering in Canada is only 8 percent of all graduate students vs 47 percent in Japan, 18 percent in France, 15 percent in Korea, 14 percent in Brazil, Sweden and the United Kingdom.

Given the restricted size of Canada's R&D effort and domestic market, almost all workshops emphasized the need for importing technology from abroad in order to satisfy Canadian needs, generally at much lesser cost and in a quicker time frame than new technology generated internally. This applies especially to small and medium-sized firms in manufacturing which do not possess the internal capability to reach the desired goals. However, the idea is to adapt and incorporate these foreign technologies to reach greater profitability and then, for our companies to generate new development themselves and eventually, in turn, capture new export markets.

It is also the feeling of most of the workshops that a massive effort must be initiated by the universities and the community colleges to provide retraining of the work force with regard to the new technologies. In order to do this, it is suggested that the federal government provide these institutions with the funding necessary to acquire state-of-the-art equipment.

One of the fundamental needs of Canada is to upgrade quickly the quality of science and mathematics teaching at the primary and secondary school level, which is at the present time pathetic. No less than a massive national effort is required in this area if we are to cope with the challenges of the 1990's. Importantly, great attention must be devoted to the training of women teachers for science and math. It's no small wonder that we have so few women scientists and engineers in this country, considering the scientific illiteracy prevailing at the primary and secondary school levels.

The world has changed tremendously over the past 25 years and it is likely to change even more towards the year 2000. Science and technology must now become part of the culture of Canadians and means must be found to disseminate widely and effectively new scientific and technological knowledge across Canada. This is being done now in Quebec with excellent magazines: *Quebec-Science*, for the secondary school and college students, and *Science et Technologie* for the university students and some 100,000 professionals.

People outside of Ottawa who took part in the workshops have strongly advocated a regionalization of science and technology efforts across the whole country, geared to regional aspirations and capabilities and with local community involvement. However, this strategy ought to be based on regional strengths in certain technological applications.

It was widely felt among the participants that we need a strong information base and that the information system needed by the various sectors ought to be modern and efficient, with quick response time. It was also commented that among the many roles played by NRC, one of its most useful functions for industry is that provided by its scientific and technological information officers, the number of whom should at least be doubled across Canada.

Several participants raised concern about the tendency of the press to emphasize the conflicts between the various segments of our society rather than stressing the concerted efforts that take place and the public acceptance taking place. Indeed, the introduction of new technology is often portrayed from a detrimental standpoint rather than presenting, at the same time, its major socio-economic benefits.

There is much to be done. Now is the time for putting our act together as Canadians. Tomorrow will be too late. We have a bright future. Let's invest in Canada!

THEME 4: ADJUSTING TO CHANGE

Miss Jennifer McQueen
Commissioner, Public Service Commission of Canada

There was unanimous agreement that education was one of the most critical factors, but at the moment it is not a funding priority and some of those best qualified to teach the new technologies are being hired away to government-financed research laboratories. Why cannot some of this research be located in the universities to stimulate and involve the faculty and students? Practically every workshop urged a closer cooperation between industry and academia. Those with front line experience in industry should be involved in teaching at the universities and as members of the boards of educational institutions. And the techniques of high tech itself should be used to impact knowledge on those living in remote areas. But universities were cautioned not to forget research and teaching of the impact of science and technology on our society. A coordinated national education plan was recommended and one workshop called for a National Forum for Education involving both the federal and provincial governments and industry with the academics.

There was dissatisfaction expressed with the quality of teachers and education at the secondary school level. Some felt that the teachers are out-of-date. Young girls need better vocational guidance for course selection in the early years of their schooling. Otherwise we will lose 50 percent of our resources. Above all, we have to prepare our young people for a life of continuous change, learning and development. It is their life skill which is more important than any specific technical competence which will be out-of-date in only a few years.

But we are reminded that schools are very conservative organizations and they will never be ahead of society. While we may decide that the cognitive process is more important than particular facts, there will be instant complaints if the kids don't know the capital of Saskatchewan. Until we can publicize some of the attitudinal changes required of society so that the parents understand it, the schools will be reluctant to change.

Someone said that no amount of high tech is going to make a badly managed business into an efficient one. If the management skill is not there, everything else is a waste of money. Small business needs help in getting up-to-date management training. It also needs a drop-in centre where technical information and experience can be exchanged. It was suggested that small business be encouraged to form consortia for training and retraining.

There were several ideas involving a much closer linkage between retraining and Unemployment Insurance. One suggestion was to phase it out entirely but pay people to take training or to perform services to improve the quality of life in our society. But there was opposition to the content of their training being determined centrally. Market forces should determine it.

While new technologies may be advantageous to some physically handicapped persons, it is important that specialized training be provided for them to be able to take full advantage of it.

More than one participant noted the importance of identifying appropriate leaders among employees who can act as catalysts to help others in the workplace to adjust to change and to train on the job.

Many participants felt that the public is poorly informed regarding the technical revolution and therefore fears it. They have had too much hype and too few facts. Media coverage has, in most cases, been sensationalist, focussing on the downside. Speakers called for more sophisticated reporting and expecially for fuller coverage of developments in science and technology here in Canada. Governments and industries should promote popular articles and sponsor TV shows that "take science and technology off their pedestal". Another suggestion was for a Standing Committee of Parliament on Science and Technology to keep the issues before the public.

Every workshop reported a commitment to closer cooperation between all the players but ideas on how to achieve this were more difficult to find. One participant referred to a "dialogue des sourds". The governments, unions, industries, etc. all have vested interests but they have got to start trusting each other. Mechanisms which can break down the rivalry must be found. One group suggested that this might be a role for a revamped Senate.

Participants made a number of suggestions for government regulation. These included the following points:

a) combines legislation, communications regulations and requirements for regional decentralization in government spending are often unfair and counter-productive;

b) growing industries should be deregulated where technological advances are in danger of being restricted;

c) a shorter work week and early retirement should be considered as a means of job sharing;

d) more use should be made of sunset clauses in regulatory legislation to end the multiplicity of regulations which impede development;

e) structural barriers to innovation in pharmaceutical research should be removed; and

f) government funding should not be allowed to influence the location of industry; economic factors should determine this.

Specific incentives to assist technological development were suggested by workshop participants. These included the following:

a) tax incentives would encourage industry and individuals to undertake risks in new areas of endeavour;

b) costs associated with research and development of software should be tax deductible in the year in which the expenditure is incurred;

c) governments should subsidize the employment and training of youth at times of high youth unemployment;

d) there is a desperate need to create an improved investment climate for high tech venture enterprises, to promote greater investment from abroad, for relaxation of taxation on production tools, for more joint government-industry ventures and for better education of small investors;

e) there is a need to encourage venture capital investment by broadening criteria for Canadian projects - at present there is a surplus of capital for the high tech market;

f) a coordinated, aggressive international marketing program for Canadian high tech products and expertise should be provided through tax incentives;

g) stock option plans should be encouraged instead of concessions for companies seeking to raise capital internally;

h) companies should be compensated by government training programs when employees are given paid educational leave;

i) improved portability of pension plans would facilitate mobility of workers;

j) write-offs should be allowed on tax credits for high technology products on services donated by industry to educational institutions.

k) tax deductions for individuals should be broadened to include more types of training or self-education relevant to high tech skills;

l) government must assist in financing the cost of technological transfer, in particular between research institutions and small high tech companies; and

m) government should subsidize the high cost of entry by Canadian businesses into targeted industries such as sea-bed resources, aerospace and telecommunications.

MINISTERIAL PANEL

The Honourable Francis Fox
Minister of Communications

My remarks will be addressed to a subject which I feel has not been dealt with in depth by the conference — basically, the area of communications, telecommunications in particular, and the challenges that face us in that area. I will be commenting on the role which communications technology can play in helping us meet the objective that was described by Doug Fullerton as that of "creating an economy that is comfortable with change".

As the conference proceedings have made clear, the merging of advanced computer and communications technology is one of the main agents of change in our social and economic environment. It sets the stage for the creation of an array of new information-based technologies that includes robots, word processing machines and automated factories.

Collectively, these technologies will open new sources of wealth and affect the productivity of established industry. They will change the structure of work and the skills required for the jobs of tomorrow. By displacing human intelligence and judgment, they will alter our sense of values and meaning just as surely as the earlier transition to an industrial society.

These changes will quite obviously exert great stress on the Canadian federation. There will be horizontal stresses between those regions which are quick to adapt to the transformed environment and those which are not so quick and there will be vertical stress between individuals and groups who are able to take advantage of new opportunities and those who are not.

Our country's success in managing these tensions, and in responding to the economic and social transformations brought by the information technology will depend directly on our sense of confidence and partnership. Our history, like the history of the world, is filled with examples of people who overcame challenges as great as those we now face and they have prospered, in good part because they had a sense of common purpose.

Our own sense of identity is drawn from many sources. It is fed by experience in the family, community and workplace, as much as by national institutions. In that sense, both culture and communications play an integrating role in this process, by assigning meaningful experience and permitting the sharing of values. I think that's important — if there is no sharing of values we will not be able to meet these challenges.

But, central to our capacity to adapt to the new technologies and to benefit from the productivity improvements associated with them is the requirement for a high quality, technologically advanced communications infrastructure. Although not discussed in any detail at the conference, the future of telecommunications may be the single most important issue facing us in this country in the transition to the new information order.

First we must recognize that telecommunications is the largest, the most sophisticated, of all the new information industries. Although not widely recognized, telecommunications was the first industry anywhere to be extensively automated and now relies on the use of machine intelligence. Today, as we all know, an ordinary telephone set in any home in the country opens the doors to the largest most complex system ever designed. The global telephone network and a sample of instructions will guide the user, often without any human intervention at all, anywhere on the face of the earth.

Telecommunications also make up the country's central nervous system; they are a key element, a necessary infrastructure for future business development in Canada. Network quality is an essential condition for the development of advanced information techniques and for their application to other sectors of the economy. It is becoming increasingly obvious that information-based firms will not set up in areas where the networks are of poor quality.

Telecommunications equipment manufacturing is also one of the rare non-resource-based industries which export in large quantities. Let me give but one example: sales by Northern Telecom are now over $3 billion, world-wide, and it can be said that this firm competes with all other companies in this sector, including IT&T, Western Electric and Siemens. The telecommunications industry is also the most innovative industry

in this country; on it ride our hopes for over-all success in information techniques.

Bell-Northern Research is by far the largest research complex in Canada. This firm, together with Communications Canada's Communications Research Centre and many other small firms, carries out more than 30% of all industrial manufacturing-related research in Canada.

For all of these reasons, telecommunications is critical to the future performance of the economy and the extent to which Canada will be able to effectively compete in the new information age. But telecommunications stands at a watershed in its development.

Recent events in the United States, and the very nature of the technology, are contributing to the break-up of the old monopolies and the beginning of a new era of increased competition. That question — competition — goes to the heart of the industrial structure and raises some very difficult political and economic questions.

The policy of competition must take into account the following considerations: First, the pattern of cross-subsidies between local and long distance rates and residential and business rates in Canada is, like those in the U.S.A., extremely skewed in favour of local residential service. This means that if competition is encouraged in long distance and business services, the cost of residential telephone services will certainly rise and would, if all services were put on a full cost basis, rise significantly as they have in a number of states in the U.S.A. This is an issue which will affect everyone in the country, and one in which everyone will have a view and which would involve the reallocation of billions of dollars within the system.

Second, the Canadian telecommunications system does not fall within a single jurisdiction. Although the majority of the system is under federal regulation, enormous parts of it are provincially regulated and, in some cases, provincially owned. Thus the danger arises that if one province is more restrictive than another with respect to competition issues — and there are some who are indeed more restrictive than others — that single factor will adversely affect firms with respect to their location decisions.

This would indeed be unfortunate, because a great potential of telecommunications is that it reduces the importance of distance, making it possible for companies to locate anywhere and still be plugged-in to the most advanced networks, and eliminating, in that way, one of the key disadvantages traditionally experienced by the poorer regions in attempting to attract industry.

Finally, it is worth noting that the players involved in this issue are all enormous. Bell Canada has assets of $12 billion, making it the second largest company in Canada. Alberta Government Telephone controls over $2 billion, which makes it as large as Ford Canada, McMillan Blodell or Cominco. Even a relatively small company by industry standards like New Brunswick Telephone and Telegraph is still worth $422 million, making it larger than Westinghouse Canada and almost as big as Hawker Siddley.

There is little doubt that competition policy will be one of the major topics facing governments in this area over the next few years and, in my view, it may be the single most difficult question involved in making the transition to an information-based society with effects across the country. Given the size and the complexity of the issues, the potential for federal-provincial tension and the raw politics involved, the resolution of this question will probably be as difficult in its own way as the debate over the "CROW".

As I noted in the very beginning of my remarks, encouraging a climate that supports innovation and risk-taking is something that must pervade all of our future activities. To sum up, the central challenge that confronts us is that if we are to survive and prosper over the coming years, it would be a mistake to focus on economic development narrowly construed. Indeed, we must understand its relation to our social and cultural life more generally and pursue it in the context of the development of the country as a whole.

To put it in a nutshell, we must encourage society to foster a favourable climate for innovation in all aspects of our social, economic and cultural life.

May I be permitted, Mr. Chairman, to announce some news that is directly related to the conference you are chairing. This morning, the Government of Canada, through the Department of Communications, signed a co-operative agreement with Mr. Jean-Jacques Servan-Schreiber, President of the World Centre for Information and Human Resources.

The priority objective of this agreement will be on the social impact of new technologies; close cooperation is planned between the Paris-based World Centre and the Department of Communications, especially its research branch and the new research centre in Laval, near Montreal, which deals with various aspects of computer development. It has been agreed that, commenc-

ing immediately, Canadian researchers will work at the World Centre, in Paris, and that French specialists will come to Canada on a regular basis, under an exchange program. I am, of course, delighted with this agreement, which will allow Canada to benefit from research and development carried out at the World Centre and which will permit participation by those areas of the Canadian research community involved in communications in disseminating knowledge among the greatest world centres.

The Honourable Judy Erola
Minister of Consumer and Corporate Affairs and
Minister Responsible for the Status of Women

As I see it, this conference is concerned with two main issues: one is the use of new technology in Canada; the other is of social impact. I have a message on each of these topics and since time is short, I'll get right down to it.

Speaking first as the Minister Responsible for the Status of Women, I have this to say and I think Heather Menzies said it very well this morning. Women have reason to be apprehensive about technological change. However, the challenge facing us is not the technology itself, which really should be seen as an opportunity, but the process of adaptation. We must remember that, in this respect, women have special cause for concern.

It is true that the role of women in Canada and the workplace has expanded dramatically over the past two decades. We should remember, however, that these changes resulted from a revolution in attitudes which relatively speaking didn't happen that long ago. I think most of you are aware that Statistics Canada produced a report that indicated that in the past decade, there had been a 64 percent growth of women in the workforce as opposed to a 25 percent increase in the male workforce.

However, women shouldn't take these gains for granted. They don't want to lose them in the process of adaptation. The fact is that the majority of those Canadians who face the challenge of adaptation are women. We know for instance, as Heather said this morning, that the three areas of work which technology will change most are: clerical, service, and the fabrication, assembly and repair of products. Fifty percent of working Canadian women are employed in precisely those fields.

Of course adaptation means many things. Job content will change. Skill requirement will change — so will the relative importance of industries and geographic areas. The cards are being re-dealt and women want to be sure that they don't get lost in the shuffle. They want to be sure that measures of adaptation, job training and retraining in particular, will be designed with their interests in mind. I also believe that we must do something more in the area of support systems.

There is another concern. Some people say the new technology will reduce the need for labour. No one can be certain that this will indeed be the outcome. But suppose, for the sake of argument, that it is. Various responses and strategies have been suggested. A smaller workforce for instance. The same numbers working, but shorter hours and so on. Women, through effective participation in these issues, have made significant yet, I must admit, tenuous gains towards equal status in the workplace.

I am confident that Canada has the resources, the economic potential and the human ingenuity to adapt in ways that will accommodate these aspirations, not only of women, but of all Canadians. We are talking about building a new economy, new tools, new skills, new ideas and, hopefully, new attitudes. For what is basically an immigrant society with a pioneer tradition, these are challenges we should welcome and be very good at.

I pause now, while I put on my other hat as Minister of Consumer and Corporate Affairs. Our message is for anyone in Canada involved in new technology, its development or its use. Particularly, it is a message to small and medium-sized businesses.

I want to call your attention to a great, underutilized national resource. I usually refer to women as a great underutilized national resource, but in this case I am referring to the Canadian Patent System. The system has two roles in our national life. The first role, which most people know very much about of course, is protective. The system protects the right of innovators, Canadian and foreign. But the second role is far less well known, but even more important in this day and age. It is to assemble a stockpile of detailed information about new technology throughout the world and to make that information available to Canadians.

The two roles are complementary, two sides of a fair transaction. The inventor gets a limited monopoly in Canada — 17 years of patent protection. In return Canada — not just the Patent Office — gets all the technical information needed to duplicate that product or process once the patent has expired. We add to the stockpile at the rate of 25,000 applications a year. Full

development data and drawings, and all on a multitude of products and processes ranging from bulldozers to micro chips.

This information is valuable, not just when the patent expires, but from the first day it arrives in our files. Planners can use it to study trends in innovation throughout the world. Manufacturers can use it in many ways to find new products which they can produce either by arrangement with the innovator or directly if the patent has expired. They can also avoid the cost and the frustration of reinventing the wheel and, believe me, it's tried every day. We can give you horrible examples from both the private and the public sector.

Many other countries, including our competitors in world trade, go to great lengths to enjoy the full benefit of their patent systems. The success of many can be traced in part to an intelligent use of these resources. I'm sure it will come as no surprise to you that some countries begin teaching the patent system in grade school. And you are asking which country? Yes Japan, since 1907.

We haven't done a good job in Canada, either in terms of telling people about this resource, or in making it easier to get at. I'm glad to say that we are now taking steps to correct this. We hope to establish a system which would make this information available across Canada through a computerized network. This system, by the way, would be built on the base of existing private and government infrastructure. We, too, do not want to reinvent the wheel.

In conclusion, let me point out that 2 percent of technological innovations throughout the world are Canadian. That doesn't sound so good? Well it's not so bad when you consider that this is a population of 24 million. But it does mean that if we focus too narrowly on Canadian technology we miss 98 percent of the picture. Clearly, a nation of 24 million cannot expect to produce all the technology it needs at home. By expanding our perceptions to 100 percent, we can harness this resource to the task of building the Canada of tomorrow, with all of these tools at our disposal.

The Honourable Roy MacLaren
Minister of State for Finance

Thinking about the broad subject which you asked me to address, "Putting Technology in its Place",I found myself asking if we were really preparing ourselves for the further onset of radical alterations in the world economy, in methods of production and in the labour force. With yet greater changes to come, it is becoming even more important that government and the private sector, both business and labour, embrace coordinated and complementary roles.

In Canada, the role the governments can undertake most effectively is creating a favourable environment for technological growth and increased productivity while fully recognizing the importance of human development and liberty. This is, in a nutshell, a role of catalyst and support.

Government grants are available to the private sector to undertake research and development and to apply productive technology. The government is funding a network of technology centres, one in every province, to spur the application of microelectronics. A federally-sponsored Productivity Improvement Service examines specific industries, helps participating companies to define their productivity performance and advises them on how they might improve their productivity.

The federal government is also attempting to foster awareness about technological innovation and its impact on people. The National Centre for Productivity, announced in April's budget, will see business and labour addressing jointly the human issues arising from a rapidly changing work environment.

Discussions of these human issues often bog down in the dispute between optimist and pessimist shouting at each other across an ideological gap. There are unfortunately still few facts available to illuminate such a debate. Worse still, those which are available are resolutely ignored in favour of often fanciful speculation.

We have, in the course of the last 200 years or so, mechanized out of existence most of the arduous physical labour which has occupied humanity throughout history. In the course of the past 35 years or so, we have embarked upon the process of computerizing, out of existence, tedious mental labour.

What is left for humans? Surely, it includes those things which humans are uniquely qualified to do: to be creative; to make judgments; to exercise empathy. Creative judgment and empathy are qualities needed by policemen, nurses and salesmen as well as by physicians, judges and musicians. We need these abilities to teach, to heal and to govern. We need, and will continue to need, computer programmers and technicians certainly. But while it is clearly useful to know how to drive, not everyone in our society needs to be an auto mechanic. Without programming skills we can all access the largest computer in existence, as Francis Fox noted, the telephone system, and we are learning how to interact with the banks's computer terminals with very little trouble.

A senior bank official responsible for personnel policy has asserted that, while his bank was no longer searching for staff who could mentally add long columns of numbers rapidly and accurately, they were not preoccupied with hiring computer programmers. Rather, they were now searching for tellers who can interact with computer terminals and more importantly, deal pleasantly and effectively with clients. For the future he expected increasing emphasis on staff who could effectively market the wider range of services which computers would make it possible for the banks to offer.

It will obviously take creative entrepreneurs to develop and implement effective and profitable solutions to these human problems. From the perspective of government policy the challenge is to remove as many of the impediments as practicable to the effective operation of the information economy. The tax system is obviously a major policy instrument for government support. By reducing corporate tax rates on manufacturing projects; by creating investment tax credits on manufacturing investments; and by offering a write-off on manufacturing assets, the tax system encourages companies to plough back funds into productive equipment.

The small business sector is another example of where the government has provided incentives in the form of lower corporate tax rates and higher investment tax credits on R&D expenditures. The government's most recent proposals to improve the R&D tax incentives were tabled in April's budget, recently released as

draft legislation. Their impact will gradually become evident as the tax opportunities are exploited and more cooperation among business, government and labour give greater vent to those new opportunities. The fiscal measures will have a number of benefits, they will open up new ways for businesses to finance R&D ventures, including incentives of more immediate benefit to start-up firms. They will provide a more certain environment in which business can plan R&D expenditures.

Tax measures take time to be felt, but they will make the financing of R&D simpler, more flexible, more certain and more available. Nevertheless, we need to continue to ask ourselves whether existing tax policy might be improved, whether there are alternatives better adapted to the changing environment.

Clearly, government, management and labour all have roles to fill in better defining the needs and, more generally, in meeting the challenges of the technology revolution. I am, however, troubled by the adversarial attitudes that continue to mark relations among the three principal players in our economy. Such confrontation only retards the mutually beneficial adjustment that must be made to the changing economic and technological environment.

Implementation of technological change is a joint responsibility. The impact of new technology is so far-reaching, its potential for good or ill so great, that to impose it without appropriate consultation and planning will provoke worker resistance and disruption in labour-management relations. For this reason, democracy in the workplace has become a necessity. The participation of employees in the decisions which so profoundly affect them must be practised as a matter of continuing routine.

While it is imperative that Canadian companies apply technology in their operations, employees need to be trained and retrained if the benefits of the new technology are to be fully realized. This is another imperative which the private sector has not yet fully grasped. Management has frequently looked upon retraining as a cost, rather than as a productive investment. By and large it has not shared in the responsibility and expenses of re-education. Yet, increasing investment in humans and capital as well as technology is a necessity for virtually every enterprise. The message is clear: if Canadian business and industry are to remain internationally competitive, they must invest more in people.

In conclusion, the real challenge posed by the new technology is to shape it to the ultimate advantage of all. If we are to be the masters of technology and not its servants, then governments, labour and management must consult and cooperate more together for the common good.

The Honourable Herb Gray
President of the Treasury Board

Time doesn't permit me to do more than draw your attention to the steps we are taking within the federal government, as a major employer and an organization that is a major and massive handler of information, with respect to the technological revolution we are talking about. I invite you to learn more about our economic guidelines, our informatics task force and our own adjustment and retraining policy — we spent some $200 million a year in the training process within government.

I have also been asked to comment briefly on what the federal government, through the federal Department of Employment and Immigration, is doing with respect to helping workers adjust to structural and technological change. I want to point very briefly to such programs as our Career Access activities, designed to help people, especially those new to the labour force, become more "labour market-ready".

There are also our skill development measures, with expenditures in excess of $1 billion on national institutional training, general industrial training, practical trade-skills training and the Skills Growth Fund. All of these programs are designed to help industry and individuals acquire the skills they require with a focus on occupations in demand.

But the largest single adjustment program is the Unemployment Insurance Program. Not only because it pays benefits to those temporarily unemployed while they seek alternative employment, but also because it is now being used increasingly in a developmental way to pay benefits, while individuals are undertaking approved training or working on approved job creation projects or under approved work-sharing agreements.

Employment and Immigration Canada delivers all the above programs and many other services such as: general and special targeted employment and counselling services, ability assistance and the development of a labour market planning and adjustment agreement through a coordinated network of over 450 Canada Employment Centres. Employment and Immigration Canada has a number of follow-up activities in areas which are expected to have important implications for overall labour market adjustment. For example, a series of conferences aimed at bringing into place some consensus on the part of business, labour and provincial governments with respect to occupations in demand, both by province and sector, as part of the development of the Canadian Occupations Projection System. Also, Roy MacLaren has talked about the work we are undertaking with business and labour in developing a new Industrial Labour Market Institute and a new Centre for Productivity and Employment Growth.

Mr. Chairman, I can't resist the temptation of making a few brief comments in response to some of the observations made by the rapporteurs in bringing to the attention of the conference comments they considered important that were made during the course of the workshops.

Stuart Smith drew to the attention of the conference the issue of the role of the marketplace when one addresses the challenge of technological change within Canada. I would invite the delegates to consider to what extent the marketplace today — and certainly it is much larger than Canada, in fact it is larger than North America, there is a world-wide market — is really the product of Adam Smith's invisible hand, or rather a more direct set of rather visible hands. Not only of business decision makers outside our borders, but more particularly leaders of governments. Other governments are ready to intervene very directly or, at least, support very strongly the efforts of companies in their countries to compete in advanced technological ways in world markets.

Also, the technological revolution is one that has been praised for its potential to bring great benefits to Canada. But I couldn't help but be struck by some of the comments which raise serious questions as to who, in human terms, will be benefiting from this technological revolution — according to information presented, not women, not youth, not older workers, not the 30 percent of Canadians who are supposed to be functionally illiterate, not natives and people in remote regions. Well when I heard that comment, I asked myself "who's left?" Obviously, not very many if these are the groups under threat, under challenge, by technological change.

Well, if technological change is going to be focussed on damage, economically and socially, to such a large proportion of our population, it's unrealistic in my view to expect support from the public for such an approach — one that some argue could bring direct long-term, if not permanent, damage to some 30 to 50 percent of the population.

You can't have an approach to technological change where the change takes place and its negative effects are dealt with later, or at some indefinite time in the future, if at all. So, if the approach is one of dealing sequentially with the effects of technological change after it takes place — and if this approach is shared generally by managers and decision makers of Canadian industry — it seems to me it will have one definite result. It will create a new generation of Luddites.

Now the Luddites were people who followed one Ned Ludd in the Britain of the early industrial revolution. Ned Ludd led these people in an effort to destroy the looms in the weaving industry, which they thought were taking away their jobs. Now this time, if there is a new generation of Luddites, they'll have something their predecessors did not have, and that is the power of the ballot box. And I didn't hear anybody comment on that, as yet.

I speak to you at this point as an elected representative of working people — men and women, white collar office workers, blue collar factory workers. To have them accept the rapid and dynamic technological change that is being talked about at this meeting, they must be consulted from the beginning about its need, its pace and its effect on them. They must not be forced — and they will not accept being forced — to share what they perceive to be an undue, unfair share of the burden of the change. They must not only share, but see how they share, in the benefits of technological change from the beginning of the process. Finally, the benefits of technological change will have to be shared not only with owners, shareholders of enterprises, but with workers and, yes Judy Erola, consumers and the community at large.

Finally, I don't think we should overlook the place of economic growth in encouraging and facilitating change and the necessary adjustment to it. In this case we are talking about something that is interactive and reciprocal, and we have some experience with this fairly recent experience.

Let's look at the decades that followed the Second World War. During that period we had a high degree of technology, although perhaps not as rapid as today. Along with it came improving and increasing levels of productivity. At the same time we had increasing levels of employment, of job creation, and also what are, by today's standards, remarkably low levels of unemployment.

There is, as well, a generation of wealth in a broad economic sense — through that improvement in technological change and productivity — that helps support the development of a range of new social programs. The very programs that are providing the safety nets that some have alluded to this morning.

The process of technological change, the distribution of benefits of the wealth arising from it and the process of social adjustment, must all take place at the same time. This is the experience — the successful experience — that we went through in the decades after the Second World War. A key factor in the process of adjustment to technological change is its economic growth, and in my personal view there has to be a commitment for our economic growth, a consensus on and support of its importance on the part of business, labour and government.

In short, there is a need for a new dialogue. A dialogue that must take place, not only in conferences like this, but also in the workplace at the level of the factory floor and the office. I look forward to our new Centre for Productivity Employment and Growth — talked about as being one vital factor in facilitating that type of dialogue and consensus building.

By working together in the way that I've outlined, I'm confident that we can manage the process of change to the new technologies in a manner that, both in the short run and in the long run, will be beneficial to all of us.

MINISTERIAL PANEL: QUESTION PERIOD

Ms. Lena Kress, International Representative, International Brotherhood of Electrical Workers

I come from an organization that represents people both in the communications and the manufacturing industries and, of course, many of our people have felt the effects of technological change. I want to say that we do not, as an organization, oppose the change, but that we have some serious concerns about the effects that it has on our workers and we seek assurances that they will not become the casualties of technological change.

We have concerns, of course, on the unemployment, the retraining aspects, the health and safety issues that high technology may ensue. I was encouraged to hear that most of the Ministers talked about discussions with employees; talked about the need for consultation; the attempt to neutralize some of the adversarial system and that is of interest to me, because we have always been prepared to talk and would like to have our input prior to any changes being made. My question finally is where there is government encouragement or stimulation in a high-tech industry, has there been consideration given to discussions with the unions involved, to ensure that it's not simply just replacing jobs and that there is some protection for the people with the health and safety aspects being considered?

Mr. Herb Gray

The issue is one that is, like all the others relating to this topic, rather complex. When government is involved in providing assistance to new developments in an industry, we are dealing with issues of commercial confidentiality, the possibility that the information may be of benefit to competitors. We're also dealing with areas that in most industries come largely, if not entirely, under provincial jurisdiction.

However, I think we've made some innovating moves forward in the last several years, by linking support with commitments when it comes to the effects on workers and, particularly, to the number of jobs expected to be created. These have been written into such things and are now turning out to be very successful, for example the agreement with Chrysler.

There is also a general principle followed by the federal government in its industrial support programs, being that it does not provide support if the effect is simply to displace jobs and move them from one company to another or from one region to another.

While we haven't worked out a general mechanism for consultation with workers — for some of the reasons I have mentioned — I can assure you that a basic criterion for all our assistance is that it not have negative effect with respect to jobs.

Some of the things we've done to facilitate restructuring of industries, carried further than has ever happened in the past, includes direct consultation with labour leaders. One example is the new Industrial and Regional Development Program. The program in support of technology, and hence productivity, specifically called for a consolidated process. We've made some useful beginnings, and I hope we'll follow through further on this, bearing in mind some of the practical difficulties I have mentioned, with respect to commercial confidentiality and the jurisdiction of the provincial governments.

Mrs. Judy Erola

I would just like to add a comment and perhaps give Ms. Kress an example of how this works.

There was a firm in my area interested in robotics experiments and the grant involved some $700,000 from the federal government. But we felt that it was very important that we consult with the union to see whether this fit into their plans and how they felt about this experiment before we moved forward with the project. So there was very close consultation.

Mr. Donald Johnston

I think I'll mention that some of the most celebrated and recent contributions to the high-tech sector have created many jobs. For example, the subsidies to Pratt & Whitney over a 10-year period — almost $500 million which, in turn, will lever another $1.2 billion, creating many jobs. These are all job creation efforts and I think that is very much in the minds of all of us, particularly during this period of high unemployment.

Ms. Lena Kress

Thank you very much, it's not that we try to stop those jobs, we just want the assurance that the workers are benefiting by them.

My next question is for Mr. Fox. During these sessions, there has been a call for deregulation by some of the participants and we have talked a great deal about opportunities for advanced technologies. I'd like to zero in on the cablevision industry, which is also one that I represent. I was wondering if there was some willingness to reconsider some greater flexibility in the regulations to allow for the growth of the new technology which is really in that industry now, in particular such things as the delivery of two-way information services to Canadians.

Mr. Francis Fox

I'm struck from the conversation this morning by how far we have come over the past year and half in Canada on this issue. I remember the Science Council of Canada's document, *Tomorrow is Too Late*, telling us that we had no choice that the technological revolution was coming, and that we were reluctant in Canada to accept that basic fact. But listening to your comments, its quite clear that we have now come to terms with that — we know it's coming and were accepting it. It's an international revolution, and it's an inevitable one, it's one that we have to follow if we want our industries to remain competitive in the world marketplaces. What we're really talking about is how we try to manage that technological revolution.

The first point I would make on the regulation of the broadcasting industry in Canada is that we have been very successful in assuring the industry remains in Canadian hands. I think that's been one of the great pluses of regulation of that industry in Canada. Had there been no regulation, the industry would probably be in the hands of ABC and CBS today.

On the question of deregulation or I think in the Canadian context it would be a lot more appropriate to talk in terms of "re-regulation", if there has to be an approach to the regulatory process, which takes into account the needs of the business community, the federal regulators have to respond a lot more quickly to requests made by people who are indeed acting in a changing world.

I would be a proponent of "re-regulation", as opposed to deregulation. If you had complete deregulation of the broadcasting industry in Canada, it would be tantamount to handing it over to foreign interests in the short-term — I have no doubt about that.

We also want to have regulations in order to ensure that the broadcasting system can offer Canadians a decent choice of Canadian programming which, in turn, ensures the development of Canadian program production industries in Canada. Our policies are not protectionist, in the sense that we are perhaps the only country in the world that have gone out of their way to license cable operators to bring in foreign programming signals. So I believe anybody who wants to argue that we're protective is really barking up the wrong tree.

What we're really trying to do is to develop a strong Canadian program production industry that will be able to compete with other program production industries in the world. To my mind, cable has a future inasmuch as it can compete with the direct broadcast satellites that are just around the corner...perhaps 2 years away at the most. But they can only compete by offering services that will be more extensive than those to be offered by direct broadcast satellite. So, I think in the future cable organizations will be giving Canadians both programming and non-programming services.

Dr. Hugh Wynne-Edwards, Vice-President, Research, Alcan Limited

Out of all we've heard today, it's difficult to pick the key question. But I think it has to revolve around the fact that Mr. Fox has just alluded to: that we are recognizing the mounting tide of international competition and the scale of the challenge that we are facing. This meeting has done a lot to convince me that we really are accepting that.

Earlier in his remarks, he spoke of forging a common purpose and sharing values and overcoming our fears. I think that taps the crucial question that has come out of this meeting — it's the need for consensus. We're all tired of the adversarial system; we're all tired of fighting with each other. I think there is a sense here that we should be facing the rest of the world with a more common front. It occurs to me that, as we listen to the variety of programs and the initiatives that the government has taken, they tend to be bilateral in character. In other words, they're rifle shots trying to develop some connection across a particular interface. What I feel this meeting has been searching for is some kind of multilateral communication that puts labour and professors and managers and government people together. That's a very complex question. But I'm sure our panel of Ministers have thought about it deeply and I wonder if they care to make remarks about what kind of new models we might explore as a country.

Mr. Herb Gray

The interesting thing about the National Centre for Productivity is that we, as a national government, are not trying to dictate from above as to the form it should take or the exact role it should play. We have a general point of view, a general concept of a need to provide a focal point, a central place in Canada for dialogue and consensus building on how to achieve both productivity and employment growth.

We do not think these objectives are, in any way, inconsistent. What we have done is to call upon a group composed of senior leaders of business and labour, which is now in place, to develop the concept. They have been having a series of meetings and we hope that they will report back to us very shortly on how they see this Centre operating.

I might say, and I'm not suggesting this will be the format, we do have one successful example of something in this area. The Canada Occupational Health and Safety Centre based in Hamilton, was created as an addition of the federal government with some support of federal funding. However, it really operates at arm's length from the government, very much as a cooperative effort of business and labour with provincial government participation.

This may not turn out to be the model, and I'm not suggesting that one national centre is the only model that we need or which will take place. I have a feeling that we will need to have a multiplicity of models. These would range from committees involving all the players in one community, as we had under the program in communities like Windsor and Brantford and the North Shore of the St. Lawrence, bringing people in the community representing business and labour and the social agencies together to discuss facilitating the process of change.

I think there is a place for a national centre to provide a focal point where consensus on how to address some of these issues can develop. If I can't respond in a more detailed way to your request, it's because we are following the very kind of approach which seems to be looked upon with favour at this meeting, one involving dialogue and consensus. Rather than setting a model for an important institution like a national centre on productivity growth from above, I look forward to a report, coming before too long, from the business-labour committee to the Ministers of Labour, Employment and Immigration and Industry, Trade and Commerce which will lead to the formal constituting of this body.

Mr. Roy MacLaren

I think the important point, as implied in what Mr. Gray has just said is that the most effective way of addressing productivity questions, which is another way of saying international competitiveness, is through a bottom-up, not top-down approach. I think we've had a tendency in Canada when we've been tempted to grapple with a question of models for business, government and labour consultation, to think in terms of a top-down approach...a grand national industrial strategy underpinned by some sort of national council.

The more effective way of approaching the question of cooperation for greater productivity is through a sector by sector approach. I think the task ahead of us is to develop some Canadian models, on a sector by sector basis, that will suit the particular needs of the Canadian economy. After all, our economy does have some characteristics which are unique.

I think that we can develop, on an industry basis, the means for cooperation, if we put our minds to modeling some institutions to serve our needs. We don't have them at the moment and we have not had them in the past. What we have had is a confrontational or an adversarial tradition which, while it may have served the broad purposes of workers and indeed management at one stage, no longer suits our requirements.

Ms. Monica Townson, Monica Townson Associates

My questions relate to the position of women in Canada Tomorrow and I make no apology for focussing on that. The Minister Responsible for the Status of Women has referred to women as a disadvantaged majority. I don't think we are latter-day Luddites. I think what women are looking for is a share of the gold, in the so-called "Golden Era" that we're supposedly moving towards.

It's clear from what has been said at this conference that there will be a very difficult adjustment period during this transition to that so-called "Golden Era". This morning we heard that women are segregated to a very limited number of occupations and we have had federal government policies directed towards correcting that situation: like equal pay for work of equal value; affirmative action; and special training programs for non-traditional occupations.

We've also heard that men's jobs are being affected and, in fact, if you've looked at the background paper in your kits you will see it suggested that women

shouldn't really worry, because they'll be able to continue in their "job-ghettos". It's really the men who are going to be out of work. Well, that is not a very good situation either and I think that is where the potential danger for women lies. If men are thrown out of work by technological change, then will that mean they'll go looking for women's work, pushing women back into traditional domestic roles?

In case you think that's a very far-fetched idea, suggestions to that effect have already appeared in our national media and I suspect it might be an unspoken assumption on the part of some people even at this conference. I also think that move might be exacerbated by the technology that allows work to be moved back into the home, where people can work at computer terminals. One major employer, who incidently is under federal jurisdiction, has suggested it has about 9,000 clerical jobs that could be done by women in their homes right now — and I stress *clerical jobs*, not creative-type jobs. This employer thought this was a great idea, because women would be able to work and look after their children at the same time.

Those are the negative aspects of the new technologies which lead me to three specific questions. The first one, which I'd like to address to Mrs. Erola and Mr. MacLaren, relates to support systems and to the recognition that the typical family in Canada is now one in which both parents are in the workforce. I'd like to hear the views of those two Ministers on what might be done to change our tax system, to implement things like paid-parental leave and day care, to provide a support system for the two in a family. The second question, addressed to Mrs. Erola and Mr. Gray, is: what special measures they feel might be needed to ease that transition, from what we have now to the other system? Do they feel these safeguards are necessary? What kind of safeguards in terms of government policy will prevent the negative aspects of development.

The final question, directed to Mr. Gray, concerns training. A lot of the training initiatives have focussed on training for non-traditional occupations and they haven't been a smash success. I have to admit that and I'm sure the Ministers here are aware of it. We've heard a lot about retraining here, but we've heard very little about retraining for what. There has been quite a strong feeling that training should be flexible, that people should be generalists rather than specialists. I'd like to ask Mr. Gray if he feels there is a need to look again at the training programs that are in place and make some changes in the light of those kinds of things that have been discussed here.

Mrs. Judy Erola

I think Monica you've summed up the problems very well and I'd like to deal with the first question, which is the one on support systems.

We have not begun to look at what support systems are necessary in this country. I think we've looked at them very superficially, giving them a sort of a passing glance. Some rather superficial measures have been applied to accommodate those women who face some very real problems in the workforce. We've looked at that whole issue of maternity leave and, last year, we removed some of the basic stumbling blocs that existed in the Unemployment Insurance System — that's a good beginning.

We now have a system that does not discriminate, but I don't think it's nearly enough. I think we need to have another look at paid parental leave and how the tax system actually does affect those families. The one-earner family is no longer the norm in Canada. The norm is the two-earner family. I don't think we've come to grips with that at all, nor has our tax system. Although I give us a little bit of credit, Monica, we upped the child care tax deduction from $1,000 last year.

I think that we, as a society, are going to have to work much harder in that area. I'm rather sad that this conference, though it is based on technological change and less necessarily concentrated in those areas, has not really spent much time on that side of the equation. Perhaps, as you put it, it's because we just haven't had enough women here.

I agree with you on your second question, I think women must be very careful. I think this government is, by and large, sensitive to the kind of cottage industry which you are suggesting, meaning that women are doing two jobs at home — one eye on the terminal, one eye on the kids, with no benefits at all in the process. It's something that I will certainly take up with my colleagues whenever it appears.

Mr. Roy MacLaren

Taxation, as you know Mr. Chairman, is a vast question. I suppose we could spend the rest of the afternoon talking about nothing else. The question that immediately arises is: how many exemptions do you want to make in the tax system and what credits do you want to offer?

We've talked here about R&D credits and we could talk equally about credits concerning child care.

As Mrs. Erola has noted we have increased those recently. We've done so to a level that seemed to us to reflect maximum cost, it could be incurred but we have increased the level in recognition of increasing cost.

I suppose one could go farther and raise the question of whether, in addition to child care, should one provide some sort of house care credit? If both spouses are working, or to enable both spouses to work, should one provide some sort of credit for the cost of someone else to come in and take care of the house? This may seem a bit far-fetched, but the idea is being put to tax officials with increasing vigor by a number of people.

We're looking at a whole range of such proposals intended to increase the opportunity for women, in particular, to participate in the workforce. I have to say, Ms. Townson, that I don't mean to duck the question. The question is a complex one and I'm afraid I can't, in two seconds, do justice with respect to an answer for you.

Mr. Herb Gray

I'm in the same position as Roy MacLaren. We could devote another conference just to the issue Ms. Townson has asked me to address, with respect to what measures might be required on the part of government to facilitate the adjustment of workers to technological change.

These are already dealt with, in one form or another, in both provincial and federal labour laws. They could cover new areas which may well be the subject of collective bargaining, as much as any legislative change, that is, more formalized consultation procedures on the nature of the change, the reason for it, and the effects on workers.

In a cooperative and claritive way, I think there's room for building and what we're already doing is assisting business to bear the cost of on-the-job training. It's a matter of regret to those of us in government that, perhaps because of the financial pressures of the recession, business has not been making much use of this assistance. It hasn't been using all the funds available to carry out on the job training. In fact, I've been told that among the first people let go by some of the companies have been the apprentices. I think we have to deplore this in terms of its long-term application.

We have to examine such concepts as facilitating short-term leave, where education for a new job or a new way of doing a job can best be done in an educational setting. I think that, as much or more than any involvement of government, there has to be a new culture at the level of the factory, or the office, and the workplace in general.

We see some very good examples where, not only do we have a form of interactive and almost participating involvement in the carrying out of an enterprise, but we also have the result of input from the workers — input on how best to carry out the change and how to capitalize on a resource that, in many cases, was lost. I recently visited the Sinco operation where they have been carrying out this type of management from the beginning. I'm told it's somewhat easier to do in a new, emerging enterprise than in a traditional business. But certainly in the auto industry today, we see some very important examples of the approach to interaction between management and labour — to not only facilitating technological change, but facilitating the adjustment.

Some of you may have seen the latest issue of Fortune magazine in which there is a very striking portfolio of photographs showing the complete rebuilding of the Chrysler assembly plant in Windsor. It is now the most advanced reassembly plant in North America and perhaps the world with, among other things, 123 robots.

The workers are now back and the new product is coming off the assembly lines and, as far as I'm aware, there has not been a reduction of employment. The people who were doing the welding now done by the robots are, as far as I'm aware, employed, but they're doing other things. There is a whole new range of employment in terms of maintaining, repairing and generally servicing new kinds of equipment. This was obviously brought home in a consultative fashion with the workers right from the beginning. They didn't regret the two or three months lay-off to facilitate the rebuilding of the plant, because they knew it would bring a stability of employment that they otherwise wouldn't have.

I know it's not part of your question, but I can't help raising a consideration of the extent to which technological change, and the productivity it generates, will simply stabilize employment for the existing workforce. This without providing opportunities for those entering the workforce.

Now, if I can deal with your final question with respect to training. I'm not sure I agree with you when you say that up to now our training, or retraining, has been simply for non-traditional occupations. It's my information that we have been striving to train people for occupations in demand. We have been trying to establish a better system of projecting occupational demand.

This obviously requires the involvement of the private sector and provincial governments. That is why we are establishing a national system of projecting occupational demand in the Canadian Labour Market and Productivity Centre. We have to do a better job of assessing what occupations will be in demand in the short run, but even more so in the longer period.

In that connection I would agree with Ms. Townson: we can't train or retrain people in a very narrow way. We have to make sure they have a good basic education, so they'll have the flexibility to enable them to be successfully retrained two or three times during their working life. I hope that we will make sure our evolving national training system is sufficiently gauged to respond to that reality.

Dr. Gilles Paquet, Dean, Administration, University of Ottawa

It is no small pleasure to be able to address five ministers of the Crown. Those of you who have tried to meet one of them for lunch or who have had to line up for months have every right to be envious. I plan to take advantage of this opportunity to push them beyond the limit.

It seems to me that there are two basic myths that are in danger of getting credit as a result of the conference.

I said two myths, because I heard people around the table saying: "now we've come of age and we've understood the technological challenge." Those of us who are old enough to remember Maurice Lamontagne and the formation of the Science Council are old enough to remember that these things last one day. To me that's the type of impression I get when I hear that we've now understood what the technological challenge is about, or what productivity is all about.

I'm reminded of a play by Unesco called "Rhinoceros", in which people are turning into rhinos on all sorts of occasions. The obvious sign that you're going to turn into a rhino in the next minute is that you declare yourself immune to that illness. It seems to me that by declaring ourselves knowledgeable now and ready to face the challenge, we are in fact so incredibly complacent that I think it's not possible to think otherwise.

When I hear that people have decided to index their wages to productivity increases rather than the price index, I'll be more sympathetic to the view that we've understood what it's all about.

It's very nice to know we are now all committed, but unless there are big bucks behind those small words, it seems to me that Canada will remain in this technological race very far behind everybody. My question to Mr. MacLaren and Mr. Gray is "is there any reason to believe there will be a major financial commitment to ensure Canada will enter the technological race now, instead of simply hoping we will forget about all of that in the next while?"

My second question follows on David Golden's statement of yesterday night, about the so-called more humane aspect of the whole thing. We've heard so much about the cost of technological change — starting with Mr. Trudeau emphasizing that fact and Mr. Jean-Jacques Servan-Schreiber taking a more catastrophic view in quoting millions of jobs destroyed — that I'm worried those who were absent from this conference will, therefore, not be heard, even though they are probably more important than those who are yelling louder.

If the young, who are supposed to be hurt very much by technical advance, it seems to me, if they were here today they would be the ones who would say "baloney". On the question of women, who will supposedly be hurt by technological change. You must remember that a 64 percent increase (in employment) is a big increase. The last decade has been a decade of rapid technical change. There may be another side to that coin, a side that would indicate an active role in promoting technical advance and productivity increase may indeed have benefits that are shared more widely.

My question to Mr. Fox and Mrs. Erola: Is there any reason to believe that we will focus on matters like management? We've dealt with technical change here, not the management of it. Is there any reason to believe that there will be also big bucks put into social sciences? The social scientists, who are absent from here, are obviously the "go-betweens" — between the engineers who have good ideas and the people searching for good ways to do things.

We know we can import a lot of our technology from outside, nobody would import changes in our institutions or ways to adapt in a sort of comfortable way to this change. Is there any reason to believe that we will have some major systematic support for social science research in this country instead of a decline in it? Mrs. Erola, is there any reason to believe that we will in fact not always play the dark side of the coin in the case of technical change?

We must illustrate that this society is not a backward society, it's one in which the benefits can be

shared. It seems to me that we will go back into a view that we should become Luddites. It will come from the propagation of the myth that technical change will hit every minority group when in fact, if there is any reason to believe that some of the studies we've had even at pass background paper of this Conference, this is not going to be the case.

Mr. Roy MacLaren

I spoke earlier of a uniquely Canadian situation and nowhere is it more evident than in the question of funding for R&D. I say that, because we are competing with a large degree of foreign investment, which typically conducts its R&D at the centre of the multinational corporation, rather than at the branch plant or the periphery of its operations.

In Canada we have historically sought, through government action, to offset that apparent disadvantage, initially with perhaps the National Research Council moving forward from there with major government funding programs. That circumstance demands a secondary question, touched on earlier today. Who decides if there are going to be substantial amounts of public money made available, taxpayers' money made available for the support of R&D in Canada and the application of new technologies? The marketplace is obviously imperfect with such a high degree of foreign investment. Therefore, does the government decide? The government playing "God" is a difficult task.

I guess a short answer to your question is: Yes, substantial amounts of moneys — whether in the form of tax expenditures, tax incentives or direct grants — will continue to be made in Canada. As such, we have to recognize in some degree, the high levels of government deficit which give so many people concern in Canada include this type of initiative — initiatives which do not pay immediate benefits, which only over a period of years bring about that benefit. So, while supporting a high level of tax expenditures or direct grants, I would caution us all to recognize the implications of so doing.

Mr. Francis Fox

I have listened with great interest to Professor Paquet's opening remarks. I don't know whether his comments were meant to pique those of us who sit here before you. I have always found him to have a very colourful speaking style, and I have a great deal of admiration for his *oratorial* skills.

However, I in turn have identified three myths in what he has told us this morning—myths that are often propagated at a conference such as this. The first myth is that nothing good can come out of Canada. I will call this the "Canadian complex." Professor Paquet, perhaps to annoy us, seems to be saying that nothing good can come out of this conference. I feel that this conference has been *excellent*, and I refuse to conform to the practice of focussing on the negative aspects of a project instead of regarding the whole and saying "Well done! We have accomplished something positive. We have made an *excellent start* in the development of a government policy in this sector."

The *second myth* that Professor Paquet expounded before the television cameras yesterday is that governments have not invented anything. He is perfectly correct in saying that. The myth is that the role of government is to invent things: the role of government is to establish a climate favourable to innovation and investment.

The *third myth* is that we in Canada still do not understand the consequences of the technological revolution. As I was saying at the beginning of my response to Ms. Kress, people in at least some parts of the country today realize that this revolution is an international revolution, and that as such, it is inevitable. Either we take part in it, or it will invade us from the outside. Because it is inevitable, it is imperative that we embrace it, if we are to maintain our prosperity and to have a bright future. To say that we do not understand it, is to say that we have not lived through a depression in the last few years.

Those who are in touch with the people of Canada also realize that Canadians today understand this technological revolution. We have only to talk to the heads of the unions, in our automobile plants and in some of our other plants, to realize just how well they understand its importance. Union leaders understand that the issue is not whether the technological revolution should or should not take place, or whether certain jobs should be preserved, but whether the plants that are operating today in various sectors of Canadian industry will be open tomorrow. It is the very existence of these plants that is at issue.

As for young people, those who are unemployed also realize that it is partly as a result of the technological revolution. I repeat, Professor Paquet has advanced three myths here this morning. It is no doubt the Socratic method, so popular in universities, which provokes us to answer in this manner.

I in turn wish to ask Professor Paquet a question. He raised the extremely important issue of the financial resources made available to the social sciences. The social sciences, as I said in my preliminary remarks, are without question as important as the other sciences. A technological breakthrough has extraordinary importance, but a development in the social sciences has consequences that are even more important because it teaches us to live with technological change. The recurring argument in this connection, I have noticed, is that the government should inject more money into the social sciences.

The question I would ask Professor Paquet is this: When will the social sciences community in Canada understand that, at some point, an effort must be made to stress certain themes in social science research? In our discussions with that community we are always accused of urging social scientists to conduct research that has application in Canada, they are even forced to justify research on Beowulf. I have nothing against Beowulf; on the contrary, I find his work extraordinary. However, I also feel that there is other research that could be done in Canada at this time, and that social science research applicable to Canada can be done only by Canadians. We cannot expect American researchers, sociologists and social scientists to do it for us. Why are social scientists in Canada not pushing for more research directly applicable to the Canadian context?

Mrs. Judy Erola

It's difficult to add to that eloquent response. But, I'd like to say that this government has been working very directly with the women of Canada in the field of social sciences through many avenues.

One such avenue is the Advisory Council on the Status of Women, which has a budget of $4.5 million and spends the better part of its budget on research projects. Dr. Margaret Fulton, who is here today, has done a study for the Government of Canada and has worked with us directly on some studies. So too has Heather Menzies and I feel that some of the grants that this government has made in this are largely unrecognized.

I'd like to refer to the women's program under the Secretary of State, where a great deal of work has also been done. I should also like to tell you that the Advisory Council on the Status of Women has been working directly with the Department of Communications on the "Office of the Future" project for something over a year. That's just a brief sketch of what is happening.

This summer I had the opportunity to read a book called, *Of Human Scale*. The author said that the most profound revolution to have taken place in the last 100 years was the women's revolution. It was all the more significant because it had been non-violent. Count your blessings, Professor Paquet!

Mr. Donald Johnston

I would just like to add one comment. When you talk about vast sums of money, the budget tabled by Marc Lalonde had more funding in it for research and development and scientific endeavours generally in Canada than any budget in the history of this country — by a very wide margin.

You may recall $300 million was devoted to research centres. There was a further $100 million devoted to specific initiatives, one of them being this very conference, and tax expenditures have been tabled which will, in turn, add hundreds of millions of dollars to these efforts. So I think when you talk about vast sums of money being directed into this sector, we've seen it happen in the current calendar year, 1983.

Dr. Gilles Paquet:

Most certainly, Mr. Chairman, your precedents in this direction had been appreciated by the community, as you well know. Mr. Fox quite rightly perceives that one of the roles of this panel was probably to push the Ministers beyond their limit.

We have not spent a portion comparable to what our competitors are spending. My point has been, and remains that, unless there is a commitment of a major scale by the Department of Finance — not stopped by the Treasury Board — there will be a very serious problem in catching our competitors especially when the Japanese have already announced that they had to accelerate the process of investment in this technical advance.

I was reassured, ever so slightly, by Mr. MacLaren and not reassured at all by the silence of Mr. Gray. On Mr. Fox's statement: I don't think I suffer from the 'Mal canadien' as he put it. I don't think we do everything wrong. We're not perfect but we do a number of things right. I think it's quite important to recognize there have been a number of false starts which have led all of us. I was involved with the Lamontagne Committee in the late 60s and early 70s and I believe then that we had managed to alert people to the importance of facing the

need for a science policy in this country. I must admit that 15 years later, I think we have gone full circle.

I fully agree with Mr. Fox, that we need to do a lot of research in the social sciences. During my period as President of the Social Science Federation, we were able to produce evidence that the 12,000 social scientists in this country, when the time came, were able to come to the support of the Minister — to decide and convince their troupe that there had to be priority. My point is that, in real terms, we've been allowing the funding of social science research to decline. I happen to believe, being in the faculty of management, that engineers with good ideas, not completed and complemented by managers of some quality is not a winning team. If we are going to be in a position to do anything good, and to solve many of the problems that Mrs. Erola referred to. It will be through a better knowledge of what our society is all about.

CLOSING REMARKS

The Honourable Donald J. Johnston
Minister of State Science and Technology
Economic and Regional Development

Ladies and Gentlemen:

I'd like to say that I hope all of you who have participated so actively have enjoyed these two-and-a-half days as much as I have. I found them to be very constructive and very stimulating.

When we first considered the merits of an event of this kind, we had certain objectives in mind, which you've seen. I think those objectives have been accomplished. The extent to which public awareness has been raised is something, of course, that we cannot judge at this point.

But it's also clear that we've initiated something and there seems to be momentum building here. We've touched on many issues, which I'm not going to repeat, but there's much work obviously left to be done in developing a consensus for action. This week could only be considered to be the beginning of an on-going process of exchange that we must continue to pursue in the weeks, months and years ahead. My colleagues and I will have to immediately address the kind of mechanisms and initiatives we must take to assure that takes place.

Last evening, I had an opportunity to thank all the men and women who helped to organize this conference. Today, I would like to express my gratitude to all the participants — those who are still here and those who have already left; they have contributed both time and effort to ensure the success of this conference.

I am also grateful to the workshop coordinators, who did a magnificent job, and to our special guests, who were kind enough to share some of their ideas with us.

Lastly, of course, I would like to thank the Prime Minister and the speakers, who have made this conference an event that we will remember for a long time.

I thank all of you, and I would now officially declare the Canada Tomorrow Conference closed.

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